Biotechnology Eligibility Test (BET) for DBT-JRF Award (2012-13)

Government of India, Ministry of Science & Technology, Department of Biotechnology, New Delhi

(Coordinated by University of Pune)

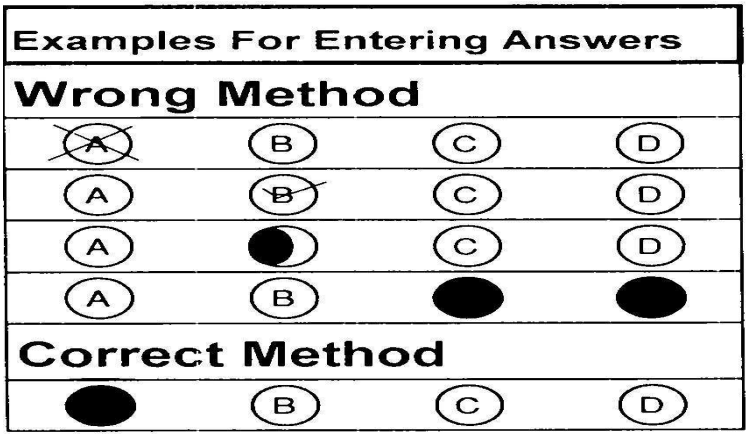
April 15, 2012 **Total Marks – 300** **Duration 10.00 a.m. - 12.30 p.m.**

N.B. 1) All questions in Section A are **compulsory.**
2) Answer any 50 questions from Section B.
3) In case more than 50 are attempted, first 50 will be considered.
4) Each question carries 3 marks; for every wrong answer, one mark will be deducted.
5) Write your seat no. strictly inside the space provided on the Answer sheet.
6) Answers marked inside the question paper will not be evaluated.
7) Please return the question paper along with the Answer sheet.

Instructions for filling the Answer sheet:

1) There is only one correct answer for each question and once a mark has been made the same cannot be altered.
2) All entries in the circle must be made by **BLACK ink Ball Point Pen** only. Do not try to alter the entry.
3) Oval should be darkened completely so that the numeral inside the oval is not visible.
4) Do not make any stray marks for rough work on the sheet.
5) Do not use marker, white fluid or any other device to hide the shading already done.
6) More than one entry of an answer will be considered wrong, and negative marking will be done as above.
7) Mark your answer as shown in the example.

Section A



Section A

1. The immunoglobulin fold is made up of
   (A) seven alpha-helical segments
   (B) a beta-barrel
   (C) a sandwich of two parallel beta sheets
   (D) a sandwich of two antiparallel beta sheets

2. RNA is analyzed for the location of hairpin folds. Which of the following sequences could form a mini-hairpin?
   (A) AGGUUUCCU
   (B) AAAAAAAAA
   (C) AGGUUUGGA
   (D) AGGUUUAGG

3. Increasing the concentration of which of the following would most effectively antagonize the inhibition of protein synthesis by puromycin?
   (A) ATP
   (B) eIF2.GTP
   (C) aminoacyl-tRNAs
   (D) peptidyl-tRNAs

4. Enzymes catalyze reactions by
   (A) binding regulatory proteins
   (B) covalently modifying active-site residues
   (C) binding substrates with great affinity
   (D) selectively binding the transition state of a reaction with high affinity

5. Which of the following is a common reaction used for the formation of phosphatidyl ethanolamine in bacteria?
   (A) decarboxylation of phosphatidyl serine
   (B) demethylation of phosphatidyl choline
   (C) reaction of ethanolamine with CDP-diacylglycerol
   (D) reaction of CDP-ethanolamine with CDP-diacylglycerol

6. Holiday junction is observed during
   (A) Mitosis
   (B) Interphase
   (C) Recombination
   (D) DNA Repair

7. In humans, XX males and XY Females are rare, such rare sexes are due to
   (A) Deletion of X chromosome
   (B) Deletion of Y chromosome
   (C) XY translocation
   (D) Duplication of X chromosomes

8. Induction of β-galactosidase activity by IPTG is due to
   (A) Stimulation of lac repressor function
   (B) IPTG binding to lac operon & inducing transcription
   (C) IPTG binding to lac I gene product and inhibiting its activity
   (D) Inhibition of β-galactosidase degradation

9. Which of the following enzymes doesn't require a primer?
   (A) RNA dependent DNA polymerase
   (B) DNA dependent DNA polymerase
   (C) DNA dependent RNA polymerase
   (D) Taq DNA polymerase

10. Which one of the following antibiotics attaches to 50S ribosome and inhibits its peptidyl-transferase activity?
   (A) Penicillin
   (B) Chloramphenicol
   (C) Trimethoprim
   (D) Amphotericin

11. DNA from a host sample can be amplified by a process known as the polymerase chain reaction (PCR). Which of the following is required for PCR?
   (A) Knowledge of the genetic sequence to be amplified
   (B) A single nucleotide primer
   (C) A universal probe to detect the amplified product
   (D) A heat-sensitive DNA polymerase enzyme

12. Gluconeogenesis is not capable of making glucose from
   (A) adenine
   (B) lactate
   (C) Acetyl CoA
   (D) palmitate

13. Glycosylation of proteins occurs in the
   (A) peroxisome
   (B) Mitochondrion
   (C) lysosome
   (D) endoplasmic reticulum

14. The 20 different amino acids found in proteins are normally coded by
   (A) 59 codons
   (B) 60 codons
   (C) 61 codons
   (D) 63 codons

15. How many microliters of 0.1 M solution of sodium chloride will make 10 ml of 5 mM sodium chloride?
   (A) 200
   (B) 100
   (C) 500
   (D) 10

16. Which of the following is NOT found inside the eukaryotic nucleus?
   (A) Nucleolus
   (B) Cajal bodies
   (C) PML bodies
   (D) Centrosomes

17. Haemolytic disease of the newborn due to Rhesus incompatibility depends upon the
   (A) mother possessing Rh antigens not present on the baby's red cells
   (B) transplacental passage of IgM anti-Rh antibodies
   (C) transplacental passage of IgG anti-Rh antibodies
   (D) production of cytotoxic antibodies in the baby

18. Hemoglobin shows sigmoidal curve for oxygen saturation. What is the shape of curve for myoglobin oxygen-binding ?
(A) Linear
(B) Hyperbolic
(C) Sigmoidal
(D) Bell shape

19. For transcription to occur in the lactose operon, an inducer must be present so that
(A) the repressor can bind to the operator
(B) the repressor does not bind to the operator
(C) the inducer can bind to the operator
(D) the inducer does not bind to the operator

20. Which of the following is not a feature of mutagenic action of 5-Bromo-deoxyuridine?
(A) It acts on growing cells
(B) It forms base pair with A in its rare form
(C) It induces transitions
(D) It affects only one strand of DNA

21. The action potential results from
(A) decrease in negative charge inside the nerve fibre
(B) increase in positive charge outside the nerve fibre
(C) opening of voltage-gated sodium channels
(D) activation of the sodium-potassium pump

22. A recombinant vaccine is available for which one of the following cancers?
(A) Adult T cell leukemia
(B) Colon carcinoma
(C) Glioblastoma
(D) Cervical carcinoma

23. A patch–clamp device is used to
(A) measure the strength of an electrochemical gradient
(B) study the properties of individual neurotransmitters
(C) infuse different kinds of ions into an axon
(D) study the properties of individual membrane channels

24. Which type of neurons among the following are predominantly lost in Alzheimer's disease?
(A) Cholinergic
(B) Serotonergic
(C) Noradrenergic
(D) Histaminergic

25. Circadian rhythm is regulated by the
(A) hypothalamus
(B) suprachaismatic nucleus
(C) amygdala
(D) basal ganglia

26. Which one of the following is the natural host for pseudo- rabies virus?
(A) Dog
(B) Man
(C) Swine
(D) Horse

27. Which one of the following is the causative agent of fowl cholera?
(A) *V. cholera*
(B) *P. multocida*
(C) *E. coli*
(D) *S. Pullorum*

28. The wavelengths of light that penetrate the least into the ocean are
(A) red and violet
(B) red and yellow
(C) blue and brown
(D) green and blue

29. Zooplankton that spend only a portion of their lives as plankton are called
(A) holoplankton
(B) meroplankton
(C) benthoplankton
(D) hemiplankton

30. Most of the sand and mud dwelling benthic organisms are
(A) grazers
(B) producers
(C) detritus feeders
(D) predators

31. The oceanic depth that represents equilibrium between oxygen and carbon dioxide production is termed the _____ depth.
(A) equilibrium
(B) compensation
(C) decomposition
(D) anaerobic

32. Which of the following is not an adaptation of salt-water fish to the environment in which they live having a higher salinity than their bodies?
(A) They constantly drink seawater
(B) They excrete salt through their gills
(C) They produce a small amount of urine
(D) They store salt in their skin

33. C^{α}- C^{α} distance plot might be useful in
(A) Identifying secondary structures in proteins
(B) Identifying globular domains in a protein
(C) Identifying active sites in enzymes
(D) For docking of inhibitors on protein's surface

34. A coin is tossed three times, what is the probability that exactly one heads turns up
(A) 0.333
(B) 0.25
(C) 0.50
(D) 0.375

35. WebIn is a sequence submission tool provided by
(A) NCBI

(B) EMBL
(C) EBI
(D) RCSB

36. National Center for Biotechnology Information (NCBI) was established on November 4, 1988 as a division of the
(A) National Library of Medicine (NLM)
(B) National Institutes of Health (NIH)
(C) European Bioinformatics Institute
(D) ExPASy

37. The parts of proteins having the highest flexibility are
(A) α-helices
(B) β-sheets
(C) peptide bonds
(D) surface side chains

38. In a typical *E. coli* fermentation, the major barrier to the transport of oxygen from gas bubble to the cells in the broth is in the
(A) gas film
(B) liquid film
(C) interphase between gas and liquid film
(D) diffusion of oxygen at the cell surface

39. Identify the method from the following that is not used for KLa determination.
(A) Pulse and shift method
(B) dynamic method of gassing out
(C) static method of gassing out
(D) overall gas balancing method

40. In a chemostat operated at steady state following Monod growth kinetics, the inlet substrate feed concentration is doubled at time t=0, then in the new steady state concentration of biomass (X) and residual substrate (S) in a chemostat will be such that
(A) S is higher, X does not change
(B) X is higher, S does not change
(C) Both X and S are higher
(D) Both X and S remain the same

41. The film heat transfer coefficient (h) for cooling water flowing in the cooling tubes of a bioreactor will……. as the water flow rate is doubled
(A) double
(B) not change
(C) decline
(D) increase less than two fold

42. For water flowing in a circular pipe, the flow rate increased so that it goes from laminar to turbulent flow then the ratio of the velocity at the centre line to velocity near the wall will
(A) increase
(B) decrease
(C) remain unchanged
(D) be unpredictable

43. Liquid is being pumped using a centrifugal pump, if the outlet valve is suddenly closed then,
(A) The outlet pipe would burst
(B) The outlet pressure would increase
(C) The pump would stop running
(D) The outlet pressure would remain the same

44. When terminal velocity is reached, the net downward force due to gravity, on the object is
(A) greater than the upward buoyancy force and drag force
(B) lesser than the upward buoyancy force and drag force
(C) not related directly to upward buoyancy force and drag force
(D) exactly balanced by the upward buoyancy force and drag force

45. A chemostat is run with a feed rate of 1 litre/h when the volume of the reactor is also 1 litre. At steady state the doubling time of the cells in the chemostat is ……..h
(A) ln 2
(B) log 2
(C) one
(D) two

46. Which one of the following promoters is not derived from Agrobacterium?
(A) CaMV 35S
(B) nos
(C) ipt
(D) virD

47. Which of the following is incorrect with respect to modification of Mendelian dihybrid ratio?
(A) Complementary gene interaction : 9:7
(B) Recessive epistasis: 9:3:4
(C) Dominant epistasis: 12:3:1
(D) Additive gene interaction: 10:6

48. An example of a co-dominant marker is
(A) AFLP marker
(B) ISSR marker
(C) RAPD marker
(D) SSR marker

49. A mapping method for identifying markers linked to trait of our interest in a natural population is
(A) Linkage mapping
(B) Association mapping
(C) Transcriptome mapping
(D) Physical mapping

50. The number of phenotypes in the F2 of the dihybrid will be
(A) 2
(B) 3
(C) 4
(D) 8

Section B

51. Suppressor tRNA mutations are those in which
    (A) Transcription of tRNA genes is suppressed
    (B) Translation from mRNA is suppressed due to absence of tRNA
    (C) Amino acid is incorporated in place of a stop codon due to mutation in anticodon region of tRNA
    (D) Charging of tRNA with cognate amino acids is suppressed due to mutation in amino acyl tRNA synthase enzyme

52. Which of the following media is best suited for the selective growth of *E. coli* with genotype: Str+ his- leu- lys- ?
    (A) Minimal medium with thiamine, histidine, leucine and lysine
    (B) Luria Agar
    (C) Minimal medium with thiamine and streptomycin
    (D) Minimal medium with thiamine, histidine, leucine, lysine and streptomycin

53. Which of the following amino acids is coded by maximum number of codons ?
    (A) Leucine
    (B) Tryptophan
    (C) Valine
    (D) Alanine

54. In cell cycle, paternal and maternal chromosomes exhibit a "bouquet stage" during
    (A) Leptotene
    (B) Zygotene
    (C) Pachytene
    (D) Diplotene

55. Which of the following cytokines is secreted by both Th1 and Th2 type of cells ?
    (A) IL-2
    (B) IL-3
    (C) IL-4
    (D) IFN-γ

56. Processing of transfer RNA involves
    (A) cleavage of extra bases from both 3' and 5' ends
    (B) nucleotide sequence specific methylation of bases
    (C) addition of sequences CCA by a nucleotidyl transferase
    (D) addition of methylated guanosine at 5' end

57. Somatic mutation of Immunoglobulin gene accounts for
    (A) Allelic exclusion
    (B) Class switching from IgM to IgG
    (C) Affinity maturation
    (D) V(D)J recombination

58. Which of the following enzymes is NOT used in pyrosequencing?
    (A) DNA Polymerase
    (B) Pyrophosphatase
    (C) Luciferase
    (D) ATP sulfurylase

59. Which of the following statements is not true for HFr strains of *E. coli* ?
    (A) F factor is integrated in the genome
    (B) Chromosomal markers are transferred from donor to recipient
    (C) They act as donors in the cross
    (D) Progeny of the cross always becomes F +

60. Which of the following organisms contains a 11 bp specific DNA sequence that acts as self-recognition sequence in natural transformation ?
    (A) *Streptococcus pneumonia*
    (B) *Bacillus subtilis*
    (C) *E. coli*
    (D) *Hemophilus infuenzae*

61. The amino acid sequence of a novel membrane protein contains four immunoglobulin-like domains and six fibronectin-like repeats. This protein is most likely a
    (A) Hormone responsive ion channel
    (B) Cell adhesion molecule
    (C) G-protein
    (D) transcription factor

62. Which one of the following viruses is not transmitted by the fecal-oral route ?
    (A) Hepatitis A Virus
    (B) Hepatitis E Virus
    (C) Hepatitis D Virus
    (D) Enterovirus

63. The earliest marker of the B-cell lineage which first appears during maturation of the precursor B cells and remains throughout the life span of the B cell is
    (A) B7
    (B) CR1
    (C) Class II MHC

(D) B220 (or CD45)

64. Which of the following repair mechanisms is absent in a cell arrested in cell cycle?
(A) Transcriptional coupled repair mechanism
(B) Excision repair mechanism
(C) DNA synthesis annealing repair mechanism
(D) Recombination repair mechanism

65. Intracellular transport in mammalian cells through vesicular fusion is regulated by which among the following GTPases ?
(A) Rho
(B) Ran
(C) Rab
(D) Ras

66. HSP70 chaperons are not present in which among the following organelles?
(A) Endoplasmic reticulum
(B) Golgi bodies
(C) Nucleus
(D) Mitochondria

67. Major gluconeogenesis occurs in
(A) Liver and kidney
(B) Liver and heart
(C) Liver and skeletal muscle
(D) Liver and adrenal gland

68. A change in which of the following genes is responsible for Fragile X syndrome?
(A) FMR1
(B) RELB
(C) FXR1
(D) FAD2

69. Molecular basis of Chediak-Higashi syndrome is
(A) mutation in a protein involved in regulation of intracellular trafficking
(B) due to deficiency of adenosine deaminase
(C) error in antigen processing
(D) reversal of anergy in self-reactive clones

70. Type III hypersensitivity is mediated by
(A) immune complex deposition
(B) antigen specific T cells
(C) complement cascade
(D) perforin and granzyme

71. Junctional diversity affects primarily the amino acid sequence in
(A) all CDR equally
(B) CDR1
(C) CDR2
(D) CDR3

72. A child stung by a bee experiences respiratory distress within minutes and lapses into unconsciousness. This reaction is probably mediated by
(A) IgE antibody
(B) IgG antibody
(C) sensitized T cells
(D) complement

73. Neutrophils are attracted to an infected area by
(A) IgM
(B) vascular permeability
(C) phagocytosis of IgE-coated bacteria
(D) aggregation of C4 and C2

74. In the immune response to a hapten-protein conjugate, in order to get anti-hapten antibodies it is essential that
(A) the hapten be recognized by helper T cells
(B) the protein be recognized by helper T cells
(C) the protein be recognized by B cells
(D) the hapten be recognized by suppressor T cells

75. Chromatin loops are formed by periodic attachment of the following onto the nuclear skeleton
(A) Histones
(B) MARs
(C) Promoters
(D) Introns

76. Telomeric DNA does not contain
(A) G-rich sequences
(B) Quadruplex
(C) T and D loops
(D) AT rich sequences

77. The ATP required for ligation during base excision repair is generated from
(A) NAD
(B) Poly (ADP-ribose)
(C) DNA
(D) AMP

78. The covalent modification of histones that is not known to play a role in regulation of gene expression is
(A) Poly (ADP-ribosyl)ation
(B) Acetylation
(C) Methylation
(D) glycosylation

79. Okazaki fragments are
(A) RNA primers for DNA synthesis

(B) Short DNA fragments after nuclease digestion
(C) Newly synthesized DNA fragments
(D) Short stretches of DNA attached to RNA primers on lagging strand

80. The changes in the electrical potential of a neuron that constitute the action potential occur in the following order
(A) depolarization-> resting potential –> hyperpolarization –> resting potential
(B) resting potential –> depolarization-> hyperpolarization – > resting potential
(C) resting potential -> hyperpolarization-> resting potential-> resting potential
(D) resting potential –> hyperpolarization -> resting potential -> depolarization

81. Suppose you were to treat a normal mammalian cell with a substance that inhibits the Na-K ATPase, what would be the most immediate effect upon the cell ?
(A) there would be no change at all
(B) the cell's osmotic balance would be disrupted and the cell would begin to swell
(C) the cell membrane potential would immediately drop to zero
(D) the cell would very quickly run out of ATP

82. In a population that is in equilibrium, the proportion of individuals showing the dominant trait at a given locus having two alleles is 84%. The frequency of the recessive allele in the population is
(A) 0.4
(B) 0.3
(C) 0.2
(D) 0.16

83. Developing T cells that react strongly with self-peptides bound to self-MHC molecules are
(A) eliminated in the thymus
(B) eliminated in the bone marrow
(C) suppressed in peripheral blood circulation
(D) allowed to function normally

84. Which of the following statements is correct?
(A) T lymphocytes are conditioned by the bone narrow
(B) B lymphocytes are conditioned by thymus
(C) B cells produce plasma and memory cells
(D) T cells do not produce cytokines

85. What is the force among the following that is primarily responsible for stabilizing the tertiary structure of globular proteins?
(A) disulfide bonding
(B) the hydrophobic effect
(C) hydrogen bonding
(D) ionic interactions

86. Which of the following sequences describes the passage of an action potential in the neuron?
(A) Axon, cell body, dendrite, synaptic cleft
(B) synaptic cleft, axon, dendrite, cell body
(C) dendrite, synaptic cleft, cell body, axon
(D) dendrite, cell body, axon, synaptic cleft

87. In the biological treatment of waste, bacteria such as species of Acinetobacter and Zoogloea are considered to play a key role in floc formation
(A) by the synthesis and secretion of polysaccharides
(B) since they are acid producers
(C) as they are slow-growing methanogens
(D) since they break down acetic acid into methane and CO2

88. During primary sedimentation and biological treatment of waste water, vast quantities of sludge are generated which are assessed by sludge volume index (SVI), defined as the volume occupied by 1 g of sludge after settling for 30 min in a 1L Imoff cone which measures the
(A) sludge thickening
(B) sludge stabilization
(C) sludge dewatering
(D) rate of acid utilization

89. Some extremozymes are found to remain active and stable up to 140°C. The decreased flexibility and rigidity of the molecule is due to
(A) highly nonpolar core
(B) reduction in glycine content
(C) presence of unsaturated fatty acids
(D) ornithine content

90. Solid state fermentations (SSF's) involve solid substrates at low moisture levels or water activities where
(A) the water content is > 95%
(B) the water content is between 40-80%
(C) the water content is between 4-8%
(D) the water content is 10%

91. The common type of duplication generates a second copy of the gene
(A) in close proximity of the first copy
(B) in a distant location on a same chromosome
(C) on a different chromosome

(D) in any chromosome at random probability

92. A silent substitution
    (A) creates a premature stop codon, thus silencing expression of the gene
    (B) substitutes one amino acid for a different amino acid with similar properties so it does not affect protein function
    (C) changes only one DNA base in a codon without changing the amino acid sequence
    (D) occurs outside the protein coding region in the 5'- or 3' untranslated region and thus does not affect protein function

93. Satellite DNAs are not typically found within which of the following parts of a chromosome?
    (A) heterochromatin
    (B) euchromatin
    (C) telomeres
    (D) centromeres

94. What is the sugar–sugar linkage among the following in the 5' cap on mRNA molecules?
    (A) 5'-3'
    (B) 3'-5'
    (C) 3'-3'
    (D) 5'-5'

95. Introduction of a non-sense mutation in a eukaryotic protein coding gene often leads to
    (A) retention of mRNA in a nucleus so it is not translated
    (B) increased degradation of the mRNA in the nucleus
    (C) increased degradation of the mRNA in the cytoplasm
    (D) decreased ribosome binding in the cytoplasm in mRNA due to its shorter size

96. What effect would 'N' mutation have on phage lambda infection?
    (A) no effect, infection would proceed as normal to either lytic or lysogeny pathway
    (B) lytic pathway blocked only lysogeny possible
    (C) lysogeny pathway blocked only lytic pathway possible
    (D) complete abolishment of infection, neither lytic nor lysogeny pathway is possible

97. The bacterial ftsZ gene is required for
    (A) septum formation
    (B) periseptal annulus formation and localization
    (C) DNA replication
    (D) transport of DNA

98. Two plasmids are of the same compatibility group if they
    (A) can co-exist in the same bacterial cell
    (B) cannot co-exist in the same bacterial cell
    (C) carry the same antibiotic gene
    (D) carry the same toxin gene

99. Replication defective retroviruses are most commonly generated by
    (A) recombination and rearrangement of sequences
    (B) mutation at critical sites in viral genes
    (C) deletion of a segment of the viral genome
    (D) Insertion of the sequences in the viral gene

100. Alu elements are
    (A) SINEs
    (B) LINEs
    (C) retroposon
    (D) DNA transposon

101. Telomeres consist of simple sequence repeats of
    (A) CA rich strands that interact with protein
    (B) GC rich strands that interact with protein
    (C) CT rich strands that interact with protein
    (D) TA rich strands that interact with protein

102. True activators of transcription are transcription factors that bind to
    (A) other proteins to enhance transcription
    (B) promoters
    (C) enhancers
    (D) promoters and enhancers

103. Position effect variegation describes
    (A) phenotypically identical cells with different genetic elements
    (B) phenotypically identical cells with similar genetic elements
    (C) genetically identical cell with different phenotypes
    (D) genetically identical cells with identical phenotype

104. The U2 snRNA basepairs with
    (A) a sequence spanning the exon intron splicing site
    (B) the 3' splice site of the intron
    (C) a sequence spanning the intron exon splicing site
    (D) the branched sequence in the intron

105. Isoelectric point of lysozyme is 9.2. When the enzyme solution at this pH in water was titrated with HCl to give a pH of 5, it was observed that six ionized glutamic acid side chains got

protonated. The net charge on the enzyme at pH 6 would therefore be
(A) +5
(B) +6
(C) -5
(D) -6

106. KCN is considered to be one of the potent poisons. You are doing an animal (mouse) experiment to test a new KCN sample synthesized by a chemist. The experiment is intravenous injection of KCN and checking the death of mouse. The sample was tested by many researchers and found to be pure and as potent as it should be. Although your experimental procedures were correct you failed to obtain desired results due to which one of the following.
(A) KCN resistant mice were used
(B) Dose of KCN is much below the LD50 dose needed to kill the mice
(C) KCN is being degraded in mice
(D) KCN is immediately filtered by kidney.

107. 6M Guanidium hydrochloride is known to denature a number of proteins. Such a high concentration is able to break down the noncovalent forces sustaining the structure of proteins by affecting
(A) Electrostatic interactions only
(B) Electrostatic and hydrophobic interactions
(C) Intrapeptide hydrogen bonding only
(D) Electrostatic, hydrophobic, and hydrogen bonding interactions.

108. Which of the following amino acids is critical in the folding of proteins due to the slow isomerization of the peptide bond preceding this amino acid depending upon the solvent environment?
(A) Tryptophan
(B) Leucine
(C) Proline
(D) Histidine

109. In peptides the values of dihedral angle phi is based on rotation around
(A) N-C^{α} bond
(B) C^{α} –C' bond
(C) C'-N bond
(D) N-H bond

110. A ribonuclease stock solution at pH 3.0 in 10 mM glycine-HCl buffer is diluted 20 fold with the buffer and resulting absorbance of solution is taken in a quartz cuvette of path length 1 cm was 0.38 at its wavelength maximum. If the extinction coefficient of the protein is 0.74 ml/mg.cm, the concentration of the stock protein solution would be
(A) 5 mg/ml
(B) 10 mg/ml
(C) 20 mg/ml
(D) 50 mg/ml

111. Which of the following techniques cannot be used to determine the molecular weight of a protein?
(A) UV absorption
(B) Viscocity
(C) Light scattering
(D) Sedimentation equilibrium

112. β-lactoglobulin which is a monomer at neutral pH is known to tetramerise at acidic pH of 2. Which one of the following techniques could be effectively employed to demonstrate the formation of a tetramer ?
(A) Native gel electrophoresis
(B) Anion exchange chromatography
(C) SDS-polyacrylamide gel electrophoresis
(D) Reverse phase chromatography

113. If two heterozygous individuals suffering from an autosomal dominant disorder marry, what is the occurrence risk for this disorder in their offspring ?
(A) 100%
(B) 75%
(C) 50%
(D) 25%

114. A man who is affected with hemophilia A marries a woman who is a carrier of this disorder. What proportion among the following of this couple's daughters will be affected and what proportion of the daughters will be carriers ?
(A) 0.75; 0.25
(B) 0.25; 0.75
(C) 0 ; 1
(D) 0.5 ; 0.5

115. Which one of the following is an incorrect association?
(A) Lysosome : synthesizes molecules for extracellular protein degradation
(B) Mitochondria : cellular respiration
(C) Endoplasmic reticulum: synthesizes proteins and sends them into Golgi- apparatus
(D) Polysomes : make large quantities of a particular protein

116. Which of the following statements about heritability (H2) is true?
(A) It is a measure of level of gene linkage
(B) It is a measure of inbreeding
(C) It is a measure of heterozygotes in a population
(D) It is a measure of the proportion of variation which is contributed by genetic factors.

117. A threshold trait is one which is
(A) expressed on a continuous scale
(B) present in a few discrete classes but is influenced by environmental factors
(C) caused by only a single gene, with no environmental influence
(D) associated with superior survival of the heterozygote

118. Which of the following describes a type of polymorphism that occurs within the gene that causes Huntington's disease ?
(A) short tandem repeat polymorphism
(B) balanced polymorphism
(C) restriction fragment length polymorphism
(D) frameshift mutation

119. 5-Bromouracil induces mutations because it
(A) replaces a T and binds to G rather than A
(B) replaces a G and binds to A rather than C
(C) changes the binding affinity of G
(D) changes the binding affinity of T

120. A homeotic mutation is one which
(A) is present only in one form in an individual
(B) results in developmental block of any tissue-specific gene expression
(C) substitutes one body part for another during development
(D) results from transposon mediated mutagenesis

121. Cystic fibrosis is a recessive condition that affects about 1 in 2,500 babies in the Caucasian population. The frequency of heterozygotes or carriers of cystic fibrosis is
(A) 1 in 12500
(B) 1 in 25
(C) 1 in 625
(D) 1 in 125

122. Which of the following would cause deviation from the Hardy-Weinberg equilibrium ?
(A) small population size
(B) random mating
(C) lack of selection pressure
(D) no mutation

123. A woman who is a heterozygous carrier of an X-linked recessive disease gene mates with a phenotypically normal male. The disease gene has a penetrance of 80%. On an average what proportion among the following of this couple's sons will be affected with the disorder ?
(A) 0.8
(B) 0.4
(C) 0.2
(D) 0.5

124. In a certain tribal population of India, the prevalence of sickle cell disease, an autosomal recessive condition is 1/100. Based on this value, what proportion of the population would be heterozygous carriers of the sickle cell disease gene in that tribal population ?
(A) 18%
(B) 10%
(C) 75%
(D) 25%

125. Cell division cycle is divided into 4 phases G1, S, G2 and M. Standard eukaryotic cell cycles are of 12 h or longer duration. Early embryonic cell cycles are extremely rapid having time duration of less than an hour. Which of the following phases are drastically reduced in embryonic cell cycles?
(A) G1 & G2
(B) G1 & S
(C) M & S
(D) G2 & M

126. Ballast water is a serious issue due to possibility of
(A) introduction of polluted water from one site to another site
(B) introduction of marine alien invasive species
(C) release of water from the ship leading to severe upwelling, causing disturbances in ocean currents
(D) several ships anchored near the harbors causing transient localized depletion of water due to uptake of seawater after offloading cargo

127. White spot syndrome virus (WSSV) is a major shrimp viral pathogen. Among the WSSV structural proteins, VP28 protein located in the viral envelop plays a major role in invasion of WSSV into shrimp. What would be the ideal strategy for protection against the WSSV infection based on the above information?

(A) Adding streptomycin or its analogues that would interfere with the production of VP28 envelop protein
(B) Creating a transgenic shrimp that would produce an alkaline protease that in turn would degrade the tail of WSSV virus
(C) Supplementing shrimp feed with glucan encapsulating VP28-siRNA
(D) Introducing *Lima lima* bivalves (filter feeders) which would selectively eliminate the WSSV due to affinity of mantle protein to VP28

128. When numbers of organisms and amounts of living material in successively higher trophic levels are compared, the values usually take the form of a pyramid, with the largest numbers and greatest biomass in the producer trophic level. However, in some marine ecosystems, the consumer trophic levels contain significantly greater amounts of living material than does the primary-producer trophic level. Which of the following is the best explanation for this?
(A) The main primary producers in marine ecosystems are microscopic algae with extremely high rates of population turnover
(B) Most consumers in marine ecosystems are filter feeders that must maintain large Basket-like structures for extracting food from the water
(C) The increased availability of solar radiation in marine ecosystems means that fewer primary producers are required to support marine food chains
(D) The largest consumers in marine ecosystems, the baleen whales, are essentially filter feeders

129. Microbial rhodopsins are a widespread family of photoactive proteins. Archaebacteria belonging to Halobacteria predominantly contain
(A) bacteriorhodopsin only
(B) halorhodopsin only
(C) sensory rhodopsin only
(D) bacteriorhodopsin, halorhodopsin and sensory rhodopsin

130. The Marshall hydrothermal recovery system is a patented proposal
(A) to exploit hydrothermal vents for their energy and minerals using dynamically positioned ship or platform position over vent and harnessing the mineral using conventional pipeline
(B) to repopulate the dead hydrothermal vents with marine organisms that would scavenge the decaying matter
(C) to recover and exploit the shrimps for mariculture
(D) with a technology to convert white smokers (low temperature plumes) to black smokers

131. Shellfish poisoning resulting in permanent short-term memory loss, brain damage and death in severe cases in humans is due to intake of
(A) the marine biotoxin called domoic acid produced naturally by marine diatoms and which bioaccumulates in shellfish
(B) the marine toxin Okadaic acid that is produced by marine sponge and is accumulated in bivalves
(C) shellfish contaminated by brevetoxins or brevetoxin analogs that are produced by dinoflagellates
(D) Saxitoxin produced by harmful algal blooms and accumulated in some shellfish

132. The most resistant population of mangroves which normally grow in high salinities inhabit the
(A) *Ceriops* zone
(B) *Bruguiera* zone
(C) *Rhizophora* zone
(D) woodland

133. Chitosan, a deacetylated form of chitin (a natural carbohydrate polymer in crab, lobster and shrimps) is used in medicine
(A) as a fungicide
(B) in plastic surgery to arrest bleeding
(C) to remove heavy metals from the skin
(D) as an antiseptic cream

134. A Slocum Glider, also referred to as an Autonomous Underwater Vehicle (AUV) is used at varying depths in marine waters
(A) to monitor microbial films
(B) to detect harmful algal blooms
(C) for marine biodiversity analysis
(D) to study the primary productivity

135. A marine bryozoan, normally causing a problem as a biofouler on boats, harbors a bacterium that has shown promise in cancer treatment as well as a memory enhancer for patients with Alzheimer's. Choose the correct answer from the following.
(A) *Bugula neritina*
(B) *Bugula dentate*
(C) *Cephalosporium acremonium*

(D) *Ectoprocta* sp.

136. Which of the following regions typically has the highest primary productivity per unit surface area of the ocean?
(A) zones of upwelling
(B) coastal water
(C) the centres of ocean gyres
(D) tropical waters

137. Biofilms interrupt the flow of ions and water to and from the substrate surface by acting as a diffusion barrier. The reduction of localised oxygen can accelerate the corrosion of a metallic substrate and is called microbially induced corrosion (MIC). An example of MIC is
(A) sulphides from SRB which cause the pitting of steel surfaces
(B) remains of old barnacle exoskeletons
(C) electrostatic interactions and Van der Waal's forces
(D) crosslinks using cysteine residues

138. Antifouling systems that do not use heavy metals are called foul release coatings (FRC).The most effective FRC presently used in the marine environment is
(A) tributyltin (TBT)
(B) biocides such as lead, arsenic, mercury
(C) fluoropolymer and silicone based polymer coatings
(D) spray coatings

139. *Porites* from Scleractinian (stony) corals have been found to be biocompatible and hence used in human systems
(A) as structural requirements for bone substitute in cranial surgery
(B) as a muscle substitute in heart surgery
(C) in the manufacture of biodegradable sutures
(D) in corneal transplants

140. The first marine derived anti-cancer drug, "Cytosar- U" used for the treatment of leukemia and lymphoma was isolated from
(A) Southeast Asian corals
(B) a Caribbean sea sponge
(C) Indian sea hare
(D) Australian waters

141. In a pairwise alignment, an optimal alignment is one that
(A) either minimizes the implied number of evolutionary changes or minimizes a particular scoring function
(B) either maximizes the implied number of evolutionary changes or minimizes a particular scoring function
(C) either minimizes the implied number of evolutionary changes or maximizes a particular scoring function
(D) either maximizes the implied number of evolutionary changes or maximizes a particular scoring function

142. FASTA was the first database search program that
(A) is much faster than Smith-Waterman
(B) is much slower than Smith-Waterman
(C) sensitivity and speed of the database search with FASTA are directly related
(D) calculates similarity index

143. RMSD between the coordinates of the amino acid gly and its mirror image after superposition will be
(A) 0.0 Angstrom
(B) More than 1.5 Angstrom
(C) More than 3.5 Angstrom
(D) More than 6.0 Angstrom

144. The radius of the following helix types in proteins follows the order
(A) pi helix>alpha helix>310 helix
(B) 310 helix>alpha helix>pi helix
(C) 310 helix>pi helix>alpha helix
(D) alpha helix> 310 helix> pi helix

145. Needleman-Wunsch algorithm, is an example of dynamic programming, which does not involve
(A) scoring a matrix
(B) setting up a matrix
(C) local alignment
(D) identifying the optimal alignment

146. RCSB is
(A) An Information Portal to Protein database
(B) An Information Portal to DNA database
(C) An Information Portal to Biological Macromolecular Structures
(D) An Information Portal to microarray

147.To identify the presence of repeats in a protein, the simplest and fastest way is to perform a
(A) self dot-plot
(B) dot-plot with another protein with same repeats
(C) dot-plot with another protein with any repeat
(D) BLAST search

148. The double-helical Watson-Crick structure of DNA was first obtained form
(A) Fiber diffraction only
(B) Fiber diffraction and molecular modeling
(C) X-ray diffraction from single crystals
(D) Diffraction from single crystals and molecular modeling

149. Molecular dynamics differs from molecular mechanics by taking into account
(A) the velocities of the constituent particles
(B) the effect of the solvent medium
(C) the non-bonded interactions
(D) the periodic boundary condition

150. Which of the following amino acid sequences belong to collagen fibers?
(A) -Gly-Ala-Gly-Thr-Gly-Ala-Gly-Thr-Gly-Ala-Gly-Thr-
(B) -Gly-Ala-Glu-Ser-Leu-Gly-Ala-Glu-Ser-Leu-Gly-Ala-
(C) -Gly-Ala-Pro-Gly-Pro-Pro-Gly-Thr-Pro-Gly-Ala-Pro-
(D) -Gly-Ala-Glu-Ser-Leu-Gly-Asn-Gly-Ala-Gly-Ala-Glu-Ser-Leu-Gly-Asn-

151. The secondary structural elements in a protein domain are in the sequence beta-beta-beta-alpha-beta-beta-beta-alpha-alpha. It will be classified as
(A) alpha+beta protein
(B) alpha/beta protein
(C) mostly beta protein
(D) membrane protein

152. The major and minor grooves of B-form DNA correspond to the following feature of A-form RNA
(A) minor and major grooves
(B) major and minor grooves
(C) deep and shallow grooves
(D) wide and shallow grooves

153. Which is the amino acid among the following that can occupy positions in the Ramachandran map that are disallowed for other 19 amino acids, but allowed for D-amino acids?
(A) Ala
(B) Gly
(C) Pro
(D) Cys

154. If side chains of amino acids interact with each other, which of the following would be termed as a salt bridge?
(A) Tyr- Phe
(B) Cys- Cys
(C) Lys- Glu
(D) Ala- Val

155. Fifth order Markov model assumes that probability of occurrence of an element depends on
(A) Previous five positions
(B) Previous four positions
(C) Following four positions
(D) Following five positions

156. In a batch cultivation, during logarithmic growth phase, specific growth rate of culture virtually remains constant primarily because
(A) medium composition is fixed
(B) substrate concentration is decreasing gradually
(C) The Ks value is much smaller than S0 (initial substrate concentration)
(D) specific nutrient uptake rate is constant

157. The continuous High Temperature Short Time sterilization processes help in maintaining media quality primarily because of
(A) short holding time and continuous nature of the process
(B) high temperature of operation of the process combined with flash cooling
(C) higher value of ΔE for thermal inactivation of spores compared to the ΔE for media deactivation
(D) High pressure obtained in these processes killing the spores more effectively

158. Identify the parameter among the following used for scale up of a shear sensitive cells in a fermentation process
(A) KLa
(B) Power per unit volume
(C) Impeller tip speed
(D) Air flow rate in vvm

159. Sterilization of air by absolute filtration mechanism is primarily based on
(A) Impaction
(B) Electrostatic interaction
(C) Diffusion
(D) Size exclusion

160. In turbulent regime, power number is ……the Impeller Reynolds number
(A) directly proportional to
(B) directly proportional to the square of
(C) independent of
(D) non linearly related to

161. When the carbon source used is changed from glucose to methanol in a bioprocess, you would definitely expect higher
(A) biomass yield
(B) specific heat production
(C) specific growth rate
(D) product yield

162. Triglycerides are accumulated by several algal species, if
(A) nitrogen source is limited
(B) carbon source is limited
(C) oxygen is limited
(D) temperature is lowered below the optimal range

163. *Acetobacter aceti* produced 7.5 g/l CH_3COOH from a medium containing initial 10 g/l C_2H_5OH when the residual C_2H_5OH concentration is 2 g/l. What will be the overall yield of CH_3COOH from C_2H_5OH compared to the theoretical yield?
(A) 70% of the theoretical yield
(B) 72% of the theoretical yield
(C) 84% of the theoretical yield
(D) 94% of the theoretical yield

164. Exponential phase is between acceleration and deceleration phase of growth. The value of μ in both the phases except the exponential phase is
(A) $\mu = \mu max$
(B) $\mu > \mu max$
(C) $\mu < \mu max$
(D) $\mu \geq \mu max$

165. Cooling water enters at 20º C in a counter current heat exchanger and leaves at 40º C while hot water enters from the other side at 70º C and leaves at 50º C The LMTD for this process will be……(for calculating temperature difference in the equation $Q = UA \Delta T$).
(A) indeterminate
(B) 20 º C
(C) 30 º C
(D) 50 º C

166. Out of various derivatives of rifamycin groups of antibiotics, which one is biologically inactive
(A) Rifamycin SV
(B) Rifamide
(C) Rifamycin B
(D) Rifamycins

167. In a fed batch process with concentrated constant feed and high maintenance coefficient of the cells, growth of the cells will
(A) show linear increase
(B) taper off asymptotically
(C) not increase
(D) increase exponentially

168. Which of the following organisms typically get their carbon for biosynthesis from carbon dioxide
(A) Glucose fermenting bacteria
(B) Anaerobic glucose respiring bacteria
(C) Aerobic glucose respiring bacteria
(D) Ammonia oxidizing bacteria

169. In centrifugation, if the angular speed is constant, the time required for pelleting cells in a rotor of larger size
(A) will be longer
(B) will be shorter
(C) will remain unchanged
(D) will not depend on angular speed or size

170. Dynamic kinetic resolution yields a maximum of
(A) 50% conversion
(B) 100% conversion
(C) 75% conversion
(D) 25% conversion

171. Which of the following groups of enzymes is not used for the kinetic resolution of racemates?
(A) Lipases
(B) Nitrases
(C) Oxidoreductases
(D) Epoxide hydrolases

172. In drug development, "Racemic switch" is introduced for the synthesis of
(A) Meso compounds
(B) Racemic mixture
(C) Eutomer
(D) Distomer

173. Which of the following pairs of amino acids is responsible for feed-back inhibition of lysine biosynthesis in Corynebacteria?
(A) Lysine and methionine
(B) Lysine and leucine
(C) Lysine and threonine
(D) Lysine and isoleucine

174. Which of the metal ions series is crucial in citric acid biosynthesis ?
(A) Fe, Zn and Mn
(B) Fe, Cu and Zn
(C) Cu, Co and Mn
(D) Zn, Cu and Fe

175. In breakthrough curve for batch adsorption, steeper the curve_____ is the adsorbent
(A) more specific
(B) less specific
(C) more porous
(D) less porous

176. A 1.5 ml of a bacterial culture consisting of 10^8/ml is used to inoculate 100 ml of medium where the cells reach a density of $5x10^7$ cells/ml. How many generations did the cells go through approximately?
(A) 1
(B) 5
(C) 10
(D) 15

177. Which of the following traits is most critical for a microorganism used in an industrial bioprocesses producing ethanol?
(A) High specific productivity
(B) High product yield
(C) High substrate consumption rate
(D) High specific growth rate

178. The degree for reduction of biomass $CH_{1.8}$ $N_{0.2}$ $O_{0.5}$ growing on glucose and ammonia is
(A) 6.2
(B) 5.2
(C) 4.2
(D) 3.2

179. The best example of product formation kinetics following Leudeking-Piret model is
(A) Alcohol production
(B) Antibiotics production
(C) Lactic acid production
(D) Recombinant protein production

180. The addition of silicone antifoam to a production fermenter has the disadvantage of
(A) reducing KLa
(B) producing undesirable byproducts
(C) increasing gas hold up
(D) makes PID control of DO difficult

181. In a two-step fermentation process to produce vinegar, starting from molasses, the metabolic product produced as an intermediate is
(A) acetaldehyde
(B) ethyl alcohol
(C) citric acid
(D) pyruvate

182. For Monod equation with substrate inhibition given by $\mu = \mu_m S/(K_S+S+S^2/K_I)$, there are two theoretically possible steady state solutions in a CSTR. Out of these
(A) both are stable steady states
(B) the lower substrate concentration represents the stable steady state
(C) the higher substrate concentration represents the stable steady state
(D) both are unstable

183. The substrate concentration used in Monod kinetics is the
(A) carbon source
(B) limiting nutrient
(C) nutrient in excess
(D) nitrogen source

184. For high cell density cultivation of recombinant *E. coli* using fed batch techniques to maintain a constant specific growth rate, the feed of concentrated substrate is
(A) kept at a constant value
(B) increased linearly
(C) increased exponentially
(D) controlled by feed back based on temperature

185. In depth filtration, the material widely used is…… fiber
(A) polypropylene
(B) polytetrafluoroethylene (PTFE)
(C) glass wool
(D) absorbent cotton

186. In a fermentor without cooling coils and a single agitator if the height to diameter ratio is decreased,
(A) area of heat transfer is decreased
(B) residence time of the bubble is increased
(C) agitator power consumption increased
(D) Both (a) and (c)

187. The product concentration in an enzyme catalyzed reaction increases linearly with time. From this we can conclude that the
(A) enzyme is deactivating
(B) reaction is product inhibited
(C) Km values are very high
(D) reaction is zero order

188. Generic drugs are introduced in the market as generic versions because they are
(A) Low cost
(B) easy to manufacture
(C) less toxic
(D) more active

189. In an aerated bioreactor, the major increase in the oxygen transfer rate, when the stirrer speed is increased is because
(A) increasing shear decreases the bubble size
(B) size of the boundary layer surrounding a bubble is decreased
(C) gas side mass transfer coefficient is increased
(D) cells come in close contact with the bubble

190. Which of the following penicillins in current use represents an unmodified naturally occurring product?
(A) Ampicillin
(B) Penicillin G
(C) Methicillin
(D) Amoxicillin

191. A type of apomixis in which embryo sac develops from vegetative cells of the ovule is called
(A) Apospory
(B) Apogamy
(C) Diplospory
(D) Polyembryony

192. Banana bunchy top disease is transmitted by
(A) *Ferrisia virgata*
(B) *Aphis gossypii*
(C) *Pentalonia nigronervosa*
(D) *Thrips tabaci*

193. The first product of photosynthesis in C3 plants is
(A) Glycerate 3 phosphate
(B) Malate
(C) Glycerate
(D) Phospho-enol pyruvate

194. Which one of the following requires back crossing?
(A) generation of Recombinant Inbred Lines (RILs)
(B) generation of Doubled Haploids (DH)
(C) generation of F2s
(D) generation of Near isogenic Lines (NILs)

195. nptII gene imparts resistance to
(A) Ampicillin
(B) Hygromycin
(C) Kanamycin
(D) Chloramphenicol

196. Agrobacterium mediated transformation of monocots requires the use of _____ for the induction of vir genes.
(A) Agarose
(B) Acetophenone
(C) Acetosyringone
(D) Cefotaxime

197. Which of the following techniques is used to obtain hybrids between two species with pre-fertilization barrier?
(A) Embryo rescue
(B) Protoplast fusion
(C) Ovary culture
(D) Embryo implantation

198. Which of the following is used most commonly in the plant tissue culture medium to induce multiple shoots ?
(A) Benzylaminopurine
(B) Naphthalene Acetic acid
(C) 2,4-Dichlorophenoxy acetic acid
(D) Indole butyric acid

199. The chemical nature of GA3 is
(A) Phenolic
(B) Terpene
(C) Purine
(D) Indole

200. Rice grains are deficient in
(A) Lysine
(B) Glycine
(C) Isoleucine
(D) Alanine

201. Lysimeter is used in the measurement of
(A) Light
(B) Transpiration
(C) Lysine content
(D) Water potential

202. Aerenchyma formation is related to which of the following hormones?
(A) ABA
(B) Ethylene
(C) Cytokinin
(D) Auxin

203. Barnase has----------activity
(A) Dnase
(B) RNase
(C) Protease
(D) Restriction

204._____is used as a bacteriostat in the Agrobacterium mediated plant transformation experiments
(A) Kanamycin
(B) Hygromycin

(C) Cefotaxime
(D) Ampicillin

205. Variation in clonally reproducing crop arises from
(A) Genetic recombination
(B) Chromosomal segregation
(C) Alternative splicing
(D) Mutation

206. In the incomplete dominance of a monohybrid, the number of phenotypes in the F2 will be
(A) 1
(B) 2
(C) 3
(D) 4

207. Seeds germinating in dark beneath the surface of the soil undergo
(A) Skotomorphogenesis
(B) Photomorphogenesis
(C) Embryogenesis
(D) Dessication

208. The substrate for photorespiration is
(A) Glycine
(B) Phospho Glycolic Acid
(C) Glycolic acid
(D) Phospho-glyceric acid

209. Mating between individuals which are closely related by ancestry is called
(A) Genetic assortative mating
(B) Genetic disassortative mating
(C) Random mating
(D) Poly cross

210. Engineering plants using chitinase gene leads to development of
(A) Viral resistance
(B) Fungal resistance
(C) Bacterial resistance
(D) Cold tolerance

211. The first GM potato developed at CPRI, India for increasing protein content in tubers consists of genes from
(A) Chick pea
(B) Pigeon pea
(C) Cabbage
(D) Amaranthus

212. Hybridization between species followed by polyploidy is known as
(A) Autopolyploid
(B) Allopolyploid
(C) Aneuploid
(D) Species differentiation

213. Source of dwarfing genes in wheat is
(A) Ganga 101
(B) Norin 10
(C) Dee-geo-woo-gen
(D) Sonalika

214. Form of IPR that helped India win Basmati case is
(A) Novelty
(B) Trade mark
(C) Geographical indication
(D) Industrial design

215. The probable Geographic Origin of the following crops is called: Wheat and barley, flax, lentils, chickpea, figs, dates, grapes, olives, lettuce, onions, cabbage, carrots, cucumbers, melons and fruits and nuts
(A) South America
(B) Mesoamerica and North America
(C) The Fertile Crescent
(D) South-east Asia

216. Administration of the DPT vaccine (diphtheria toxoid, pertussis products, and tetanus toxoid) would stimulate which of the following types of immunity?
(A) Artificial active
(B) Artificial passive
(C) Natural active
(D) Natural passive

217. Which of the following events occurs first in the differentiation sequence of human B cells in the bone marrow?
(A) Immunoglobulin light chain gene rearrangement
(B) Immunoglobulin heavy chain gene rearrangement
(C) Expression of surface IgD and IgM
(D) Expression of surface IgM

218. Loss of which of the following classes of molecules on the surface of a tumor cell target would result in loss of susceptibility to killing by host immune cells?
(A) CD3
(B) CD4
(C) MHC class I
(D) MHC class II

219. Which of the following cell types will be involved in an immediate hypersensitivity reaction due to an insect sting?
(A) Neutrophils
(B) Eosinophils
(C) Basophils
(D) Mast cells

220. Which one of the following is NOT a function of glia?
(A) providing support to the neural tissue
(B) conduction and processing of electrical signal
(C) myelination of neurons
(D) help in neuronal growth

221. Vagus nerve is a
(A) sensory nerve
(B) sensory-motor mixed nerve
(C) motor nerve
(D) lumbar nerve

222. Pain sensation is a subjective and conscious feeling. However, although the autonomic organs viz. brain, heart etc. do not get represented in the cerebral cortex, one feels pain in those parts as well. This is because
(A) these parts receive less blood supply
(B) of increased pH in those parts
(C) of the phenomenon known as referred pain
(D) these organs are not superficially located

223. In a gastrocnemius-sciatic (nerve-muscle) preparation electrical stimulation of the nerve caused twitching of the muscle. Direct stimulation of the muscle also caused twitching. When curare (a cholinergic antagonist) was applied in the bath where the preparation was maintained and the nerve was stimulated, the muscle twitch was not seen. However, under these conditions, if the muscle was stimulated directly, it twitched. These observations suggest that
(A) stimulation of the nerve was directly communicated to the muscle for contraction
(B) stimulation of the nerve was communicated to the muscle through the mediation of acetylcholine
(C) after application of curare the stimulation of the nerve did not evoke muscle twitch because the nerve was fatigued
(D) after application of curare the stimulation of the nerve did not evoke muscle twitch because muscle was fatigued

224. Nerve bundles in vertebrates are likely to contain
(A) many myelinated axons of different diameters as well as a large number of unmyelinated fibres
(B) many unmyelinated fibres as well as a large number of myelinated axons of same diameters
(C) only myelinated axons of same diameter
(D) only unmyelinated axons of different diameter

225. In Parkinson's disease, there is a predominant loss of dopaminergic neurons primarily in
(A) substantia nigra
(B) cerebellar cortex
(C) cerebral cortex
(D) locus coeruleus

226. A tissue was responding when treated with a chemical for a brief period. However, when the treatment was continued for a longer time, the response stopped. After washing and leaving for some time, the tissue started responding to the same chemical at the same dose. The reason for the reduced response is likely to be due to
(A) increased apoptosis of the treated cells
(B) increased necrosis of the treated cells
(C) fixation of the treated cells
(D) desensitization/down-regulation of the receptors on the treated cells

227. Salmons return to their specific home stream to spawn. This is an example of
(A) pheromone action
(B) reflex action
(C) imprinting
(D) circadian rhythm

228. Mark the correct statement for a normal living excitable cell at rest. The ionic concentrations across the cell membrane are such that
(A) they are at equi-potential
(B) the intracellular potential is positive relative to that of the extracellular
(C) the intracellular potential is negative relative to that of the extracellular
(D) the intracellular potential is positive relative to that of the intracellular potential of another cell

229. If the sequence of the DNA sense strand is 5' GATCCTATGCTAC 3', then the transcribed mRNA sequence will be
(A) 5' GAUCCUAUGCUAC 3'

(B) 5’ CUAGGUAUCGAUC 3’
(C) 5’ CAUCGUAUACCUAG 3’
(D) 5’ GUAGCAUAGGAUC 3’

230. Which of the following cells is important for generation of antigen-specific effector T-cells?
(A) Macrophages
(B) B-cells
(C) Dendritic cells
(D) NK cells

231. Which one of the following cells does not require processed antigen to lyse tumour cells?
(A) $CD8^+$ T-cells
(B) $CD4^+$ T-cells
(C) NK Cells
(D) Macrophage

232. Cyclosporin A is administered to patients undergoing transplantation because it
(A) downregulates TCR expression
(B) downregulates IL-2 production
(C) downregulates antigen presentation
(D) prevents recruitment of $CD8^+$ T-cells in the grafted tissue

233. In flow cytometry ‘compensation’ is used to remove
(A) cell debris
(B) apoptotic cells
(C) overlap of fluorescence spectra
(D) signal noise

234. The binding of IL-2 to its receptor in an activated T-cell is mediated by
(A) α and γ chains
(B) γ and β chains
(C) α and β chains
(D) γ chain alone

235. The D gene segment of the TCR and BCR encodes for a part of the
(A) CDR3 region of both TCR & BCR
(B) CDR2 region of both TCR & BCR
(C) CDR1 region of only the BCR
(D) CDR3 region of only the TCR

236. Super antigens bind to
(A) C β domain of TCR and non-polymorphic region of MHC II
(B) V α domain of TCR & polymorphic region of MHC II
(C) V β domain of TCR and non-polymorphic region of MHC II
(D) V β domain of TCR & non-polymorphic region of MHC I

237. ELISPOT assay is used for measuring
(A) cytokine concentration in serum
(B) antibody titre in serum
(C) frequency of B cell responses
(D) frequency of T cell responses

238. Latency is a feature of which one of the following viruses?
(A) Herpes Simplex virus
(B) Corona virus
(C) Polio virus
(D) Rabies virus

239. Which one of the following codons is used for selenocysteine during protein biosynthesis?
(A) UGA
(B) UAG
(C) UGC
(D) UCG

240. Which of the following mechanisms is useful for removal of autoreactive T-cells by the immune system?
(A) clonal selection
(B) clonal deletion
(C) phagocytosis
(D) autophagy

241. In bovines which one of the following is a milk borne infection?
(A) Ephemeral fever
(B) Milk fever
(C) Undulant fever
(D) Botulism

242. Which one of the following diseases in animals is eradicated from India?
(A) PPR
(B) RP
(C) IBR
(D) IBD

243. Which one of the following diseases is contracted by human beings mainly through agricultural occupation?
(A) Leptospirosis
(B) Hydatid disease
(C) Black quarter

(D) Malta fever

244. COFAL test is used for the diagnosis of
(A) equine infectious anemia
(B) human immunodeficiency virus
(C) avian leukosis
(D) bovine leukosis

245. Blue tongue virus
(A) agglutinates guinea pig RBCs
(B) agglutinates chicken RBCs
(C) agglutinates mouse RBCs
(D) do not produce hemagglutination

246. Buparvoquone is the drug of choice against
(A) Theileriosis
(B) Babesiosis
(C) Giardiasis
(D) Coccidiosis

247. Which one of the following is not the characteristic of Aflatoxicosis in chick?
(A) immunosuppresion
(B) wing paralysis
(C) enlargement of liver
(D) loss of condition

248. Vomiting, grey foul smelling diarrhea and gastroenteritis in young dogs are characteristics of
(A) Infectious canine hepatitis
(B) Canine parvovirus
(C) Canine distemper virus
(D) Canine corona virus

249. Most commonly affected species with papillomavirus is
(A) Cattle
(B) Equine
(C) Dog
(D) Human

250. The animal that excretes most of the virus in foot and mouth disease by aerosols even before the appearance of clinical signs is
(A) cattle
(B) pig
(C) sheep and goat
(D) buffalo
