GRASSROOTS ACADEMY
GATE-BIOTECH 2004

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GATE BIOTECHNOLOGY – 2004

1. Expression of hundreds of different genes in DNA microarray technology is monitored by using
   (A) Radioactive probe
   (B) Visible chromogenic probe
   (C) UV absorbing probe
   (D) Fluorescent probe

2. Transfer of T-DNA from Ti plasmid into plant cell is mediated by
   (A) *mob gene*
   (B) *vir gene*
   (C) *nif gene*
   (D) *octopine gene*

3. For the growth of T-cell, the growth factor needed would be
   (A) Epidermal growth factor
   (B) Interleukin-2
   (C) Fibroblast growth factor
   (D) TNF-α

4. Nick translation of DNA is a method for making DNA probes. Identify from below what is NOT required for nick translation method
   (A) DNA polymerase
   (B) DNAase
   (C) Frimers
   (D) Deoxyribonucleotides

5. During the functioning of biosensor which of the following sequences of events occurs
   (A) Enzymatic/ Cellular reaction $\rightarrow$ detector $\rightarrow$ transducer
   (B) Enzymatic / cellular reaction $\rightarrow$ transducer $\rightarrow$ detector
   (C) Enzymatic / cellular reaction $\rightarrow$ pressure gauge $\rightarrow$ time
   (D) Enzymatic/ cellular reaction $\rightarrow$ vibrator $\rightarrow$ mechanical signal

6. During the media preparation for cultivation of cells, insoluble precipitates of calcium phosphate are often formed. Identify which method can be adopted to avoid this problem
   (A) Hold the pH at 5.6
   (B) Hold the pH at 7.5
   (C) Add calcium salt first and then phosphate source
   (D) None of the above

7. Somatic embryogenesis is a procedure in plant tissue culture methodology described best as
   (A) Formation of both root meristem
   (B) Formation of stable embryos
   (C) Formation of axillary buds
   (D) None of the above

8. An immobilized enzyme being used in a continuous plug flow reactor exhibits an effectiveness factor (η) of 1.2. the value of η being greater than one could be apparently due to one of the following reasons. Identify the *correct* reason.
   (A) The enzyme follows substrate inhibited kinetics with internal pre diffusion limitation
   (B) The enzyme experiences external film diffusion limitation
   (C) The enzyme follows sigmoidal kinetics
   (D) The immobilized enzyme is operationally unstable

9. The degree of inhibition for non – competitive inhabitation of an enzyme catalyzed reaction
   (A) Increases with increases in substrate concentration
   (B) Reaches a maxima with increases in substrate concentration and then decreases
   (C) Is independent of substrate concentration
   (D) Decreases with increase in substrate concentration

10. The two columns given below indicate some of the fermentation products and the microbial cultures used for their production. Identify the correct set of groups from the four options.

| Fermentation products	Microbial cultures
(a) Ethanol	(p) *Aspergillus niger*
(b) Streptomycin	(q) *Zymomouas mabilis*
(c) Citric acid	(r) *Streptonryces griseus*
(d) Cellulase	(s) *Trichlderma reesei*

(A) a-p, b-q, c-r, d-s   (B) a-q, b-r, c-p, d-s
(C) a-q, b-r, c-s, d-p   (D) a-s, b-r, c-q, d-p

11. The culture fluids of 1000 to 5000 colonies of hybridoma are screened for monoclonal antibody by
    P. western blot analysis
    Q. antigen capture analysis
    R. northern blot analysis
    S. antibody capture analysis

    Chose the correct pair from the following
    (A) P, Q   (B) Q, R
    (C) R, S   (D) Q, S

12. Tobacco leaf discs are transfected with *Agrobacterium tumefaciens* strain containing binary vector (GUS as reporter gene) with selectable marker *nco* (kanamycin resistant gene) and then regenerated to plants. The plants are kanamycin resistant but leaf tissues are negative to GUS assay. The explanations are
    (A) The plants are transformed for both genes but GUS gene is formed off
    (B) The plants are transformed for only neo gene not the GUS gene
    (C) The plants are not transformed at all, but the devolvement of kanamycin resistance is due to somaclonal variation
    (D) All the above

13. The restriction endonuclease *HaeIII* recognizes the sequence GGI CC and the point of cleavage is given by the arrow. If you want to clone a piece of DNA in a plasmid digested by *Hae*III, what will be restriction enzyme of choice
    (A) Smal (CCIGGG)   (B) Not I (GC I GGCCGC)
    (C) Salm III (GG I CC   (D) Pst I (CTGCA I G)

14. For the sequence of ds DNA given below, identify the set of promoters required to amplify this DNA by PCR
       3′ GACTCCA .... TACAACC5′
       5′ CTGAGGT .... ATGTTGG 3′

    (A) 5′ GGTTGTA and 5′ GACTCCA
    (B) 5′ CTGAGGT and 5′ CCAACAT
    (C) 5′ACTCAGT and 5′ ATGTTGG
    (D) None of the above

15. Expression of antisense RNA of ACC synthase in transgenic tomato plants inhibited the synthesis of ethylene resulting in
    (A) Change in color from green to red
    (B) Change in aroma
    (C) Change in color from red to green
    (D) None of the above

16. Some of the genes from viruses introduced into plants in fully functional form often exhibit Mendelian inheritance because
    (A) The genes are stably integrated in chromosomes
    (B) The genes are stably maintained in vectors
    (C) The genes are co-expressed with chromosomal genes
    (D) The genes are not interrupted by introns

17. Agrobacterium based transformation of protoplasts obtained from dicots is based on the fact that
    (A) These exhibit strong chromosomal structures
    (B) These have two cotyledons
    (C) These exhibit strong wound response
    (D) These have long up root system

18. What would be the effect of addition f 2, 4-D on the production of berberine by cell culture of
Thalictrum minus
   (A) To stimulate growth and thereby uncase secondary metabolite production
   (B) Stimulate dedifferentiation and there by decrease secondary metabolite production
   (C) Stimulate proliferation and reduce secondary metabolite production
   (D) None of the above

19. Reverse veccinology indicates
   (A) From antigenic protein to vaccine development
   (B) From antigenic polysaccharide to vaccine development
   (C) From antibody to vaccine development
   (D) From genome sequence to vaccine development

20. An enzyme following Michaelis – Menten kinetics with $V_m = 2.5$ mmol m^{-1} s^{1} and $K_m = 5.0$ mM
was used to carry out the reaction in a batch stirred reactor. Staring with an initial substrate
concentration of 0.1 M, the time required for 50% conversion of the substrate will be about: (in
2 = 0.69)
   (A) 01 hr   (B) 06 hr
   (C) 02 hr   (D) 12 hr

21. The maximum reaction velocity (V_m) for an enzyme catalyzed reaction w. experimentally
measured at two different temperature and following results w obtained:

Temperature, ^{0}C	27	37
V_m mmol m^{-1} s^{-1}	2.25	4.50

The energy of activation for the reaction is
   (A) 12834 cal mol^{-1} (B) 25668 cal mol^{-1}
   (C) 6417 cal mol^{-1} (D) 19251 cal mol^{-1}

22. In a heterogeneous population of cells containing T-cell, B-cells and macrophages, the cells are
separated in the following scheme
Heterogenous → Cell suspension →   superlatant cells → nylon wool
Cell suspension   left in a Petri-plate   passed through   adhered cell
                 Plate for 3 hrs   nylon wool column
                                  ↓
                         Flow through cell

Identify the major population of cells present in Petri – plate, nylon wool adhered and nylon wool
column flow through respectively

   (A) Macrophage, B-cell, T-cell
   (B) T-cell, B-cell, macrophage
   (C) Macrophage, T-cell, B-cell
   (D) B-cell, T-cell, macrophage

23. Match the following genetic elements with their functions.

Genetic elements	Functions
a. neo^k	1. Facilitates inducible expression of genes in eukaryotes
b. SV40	2. Facilitates constitutive expression of genes in eukaryotes
c. LTR	3. Allows amplification of gene
d. *dhfr*	4. Provides way of selecting eukaryotic cells, which have received foreign DNA

   (A) a → 4, b → 2, c → 1, d → 3
   (B) a → 2, b → 4, c → 1, d → 3
   (C) a →1, b → 4, c → 2, d → 3
   (D) a → 4, b → 2, c → 3, d →1
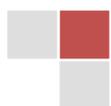
24. In the cell cycle of a typical eukaryote, the sequence of events operating in the time on cell division is
(A) S phase → G2 phase → G1 phase → M phase
(B) S phase → M phase → G1 phase → G2 phase
(C) S phase → G2 phase → M phase → G1 phase
(D) S phase → G1 phase → M phase → G2 phase

25. The kinetics of the disintegration of baker's yeast cell in a bead mill is described as dp dt = k (P_0 – P). Where P is the concentration of protein released and P_m is the maximum protein concentration achievable K is the first order rate constant and is 0.5 hr^3 for the system studied. The time required for the release of 90% of the intercellular proteins will be
(A) 10 hr   (B) 02 hr
(C) 4.6 hr   (D) None of the above

26. Inversion of sucrose by immobilized invertase follows substrate inhibited kinetics. The reaction rate (v) in mol m^{-3} hr^{-1} can be expressed as
$V = 800 [S] ; \{400 + 50 [S]: [S]^2 \}$. Where [S] is the sucrose concentration. The immobilized invertase preparation is used in a CSTR with 100 mol m^{-3} sucrose concentrations in the feed stream. If the reaction velocity passes through a maxima at [S] = 20 mol m^{-3} the feed flow rate for a reactor volume of 1 m^1 to get the maximum productivity from the reactor should be
(A) 0.11 m^2 hr^{-1} (B) 1.10 m^2 hr^{-1}
(C) 5.05 m^2 hr^{-1} (D) none of the above

27. Examine the data given below in the table on purification of a protein X

Step	volume (ml)	protein concentration (mg/ml)	Enzyme activity (unit/ ml)
Crude cell - Free extract	500	12.0	5.0
Ammonium Sulfate precipitation	125	3.0	11.0
Ion – exchange Chromatography	10	9.0	75.0

The yield present and purification factor respectively end of the experiment will be approximately

(A) 25 and 3   (B) 30 and 20
(C) 20 and 30   (D) 75 and 30