Marking Scheme 2017

99

Outside/Foreign

1. Proteome of a given cell is dynamic because in response to internal & external changes the biochemical machinery of the cell could be changed. ½ + ½
2. Freezing of a culture followed by drying under vacuum. 1
3. Osmolality within a cell is 300 m and therefore has to be maintained for- high humidity, preventing desiccation of culture medium, maintenance of correct osmolarity (Any one). 1
4. Cells will otherwise shrink or swell, cell growth/function will be affected. 1
5. DNA is biologically synthesized in the 5'- 3' direction. 1
6. George Gay. 1
7. (i) Depending on insert size.
   (ii) Nature of the host. 1+1
8. No donor is required for transfusion, no transfusion facilities, no risk of transfusion related infection (any two). 1+1
9. (a) Using restriction enzymes; Restriction enzymes will not cut own chromosomal DNA.
   (b) Type II restriction enzymes cut within the recognition sequence. 1+1
10. Pg 117 / Fig. 5 Label any two. 2
11. Curd and whey are rich sources of nutrients- essential amino acids *etc.* and have pharmaceutical compounds which elevate glutathione which detoxify xenobiotics. 1+1
12. (a) existence of overlapping genes and spliced variants.

    (b) incorrect prediction due to use of experimentally identified genes. 1+1
13. Protein expression between different samples can be compared for differential protein expression using 2-D gel electrophoresis, mass spectrometry *etc.* 1+1
14. Serum provides growth factors, nutrients, lipids, and other factors to support cell proliferation and attachment to culture vessel. 2
15. Production of food, vaccines/ Production of primary metabolites : acids, alcohol/ Production of secondary metabolites: Antibiotics/ Biotransformation reactions: Enzymatic, steroids/any others from pg.105. (any 3) 3
16. Followings are required

- Primary metabolites are chemicals used for basic metabolic processes in plants such as sugars, lipid, amino acids.

- Secondary metabolites are additional products with useful properties (e.g. Pg.120, Table 2)

1.5+1.5

17. Following statements are needed:

- Because of abnormal development of endosperm which can cause premature death of the hybrid embryo.
- Embryo rescue technique/Embryos are excised at appropriate time and cultured on suitable nutrient medium. 2+1

18. Differences between genomic and cDNA library: 1x3

Genomic Library	**cDNA Library**
All possible DNA sequences included.	mRNA is the starting material.
Large size of DNA library.	Small size.
Both coding and non coding DNA included.	Only coding part of DNA is used.

19. Followings are needed:

- It must have 'ori' for independent replication in host.
- Selectable markers to identify host cells undergoing transformation with vector.
- small in size for easy transfer into host.
- Multiple restriction sites. (any 3) 1x3

20. Fig.3/ pg 7. DNA isolated from an individual organism has unique sequence and even members within a species differ in some part of their sequence, providing fragments of different sizes when digested with a given enzyme. 3

21. Edible vaccines are better because-

- Easy delivery through oral route
- Low cost
- No storage problem 3

22. (a) Ionic bond: Interactions between oppositely charged groups of a molecule. Ionic interactions are also known as salt bridges.

(b) Hydrogen bond: formed by sharing of hydrogen atoms between two electronegative atoms such as nitrogen and oxygen.

(c) Van der Waals forces: forces of weak attraction which occur between atoms at close range.

(d) Hydrophobic interactions: the tendency of hydrophobic (water hating) molecules to come together in order to repel water. (Any three) 3

23. Fig.10/ pg 100, e.g. recombinant insulin. 3

24. *Processing raw information.

* Gene prediction.

* Protein sequence inference.

*Regulatory sequences – identification.

*making phylogenetic relationships

*Making gene discovery (any 3) 3

OR

Pg 72-73, include the pioneering role in development of computer methods for the comparison of protein sequences. 3

25. (a) LAF: Work area to be free of contamination.
(b) Inverted microscope: Allows cells at bottom of culture vessel to be visualized.
(c) Micro carrier beads: Increases surface area in scaling up of adherent cultures. 3

26. Activation at the site of function. Chymotrypsinogen is acted upon by trypsin enzyme which results in activation of the enzyme and interaction with substrate.

Mechanism of action:

- Nucleophilic attack of serine O-H *ie* O^- on carbonyl group of peptide bond to form a tetrahedral complex.
- Breakage of peptide bond by water and release of one product.
- Addition of water, second substrate.
- Acyl enzyme complex breaks giving rise to second product. 2 + 3

27. * Basic Local Alignment Search tool.

* A given sequence is compared with sequences in the data base using substitution matrices that specify score to either reward or penalize. Top scoring matches are ranked according to set criteria that serve to distinguish between a similarity due to ancestral relationship or due to random chance. True matches are further examined thoroughly with other details accessible through Entrez and other tools available at NCBI.

*Paralogs: Duplicated genes within genomes which have similarities but duffer in function.
Homologs: Descended from common ancestor and have same function. 1 + 2 +2

28. (a) n=3.3 (log107 –log 104)

= 3.3 (3) =10

t= 240/ 10= 24 min

(b) ATP measurement; measure number of viable cells; dry weight; turbidity measurement. (Any two)

(c) log phase: specific growth rate depends on temperature, pH, medium composition, and levels of dissolved oxygen. 2 + 1 +2

OR

(a) Herbicide tolerance: Over production of herbicide target enzymes/ introduction of a modified gene that encodes for a resistant form of herbicide target enzyme into crop plants.
(b) Insect resistance: Cry genes from *Bacillus thuringienesis* which are specific to particular group of insect pests are introduced into plants.
(c) Developing transgenic plants which over express the genes for one or more stress related osmolites like mannitol, amino acids, anti freeze proteins etc.
(d) Genes from viral coat proteins are introduced into plants to make them viral resistant.
(e) Hormone ethylene causes fruit ripening. By blocking or reducing ethylene production/antisense RNA ripening is delayed. When ripening is required then ethylene can be applied.
(pg 124-128) 1 x 5

Marking Scheme 2017

99/1 Local

1. Oxidation of methionine at position 222. 1
2. Log phase/exponential phase. 1
3. Bacteria grow by binary fission; viruses do not follow a defined growth pattern. 1
4. To ensure availability for future research/viability/to retain metabolite production. 1
5. To provide flexibility in use of different restriction enzymes. 1
6. Nondestructive method. 1
7. Vectors incorporating suitable signals for expressing foreign proteins in the particular host. 2
8. Seed dormancy, seed borne diseases, short lived, high cost. 0.5 x 4= 2
9. Removal of introns/posttranscriptional modifications/ posttranslational modifications/ correct 3-D folding. (any 2) 1 + 1
10.

Structural genomics	**Functional genomics**
Involves high throughput DNA sequencing	Determination of function of genes
High resolution genetic, physical and transcript map	Studying interactions between genes

1 + 1

11. Sharing of a hydrogen between two electronegative atoms; strongest when the atoms are in a linear array. 1 + 1
12. Source material/ cellular location/physical, chemical and biological property of the protein. (Any two) . 2
13. No. of genes is not related to the number of chromosomes; Genome size is not related to number of genes. 1 + 1
14. Proteins are made of 20 different amino acids and hence show diversity in size and sequence and therefore function. 2
15. Genome of both cultivable and non cultivable microbes from a given environmental area/niche. Fig.11, page 103. 1 + 2
16. Any 3 points from pg. 106, 132. 3
17. (a) Branched chain amino acids are required for muscle growth. During exercise BCAAs are released from skeletal muscle and are used as fuel. Hence BCAAs are taken by athletes to protect muscle mass.
    (b) Essential amino acids have to be obtained from diet and cannot be synthesized in the body. 2 + 1

18. Either Fig.7 on pg.122 or- Collect leaf disc and infect *Agrobacterium tumefaciens* carrying a disarmed Ti plasmid vector. The infected tissue is cultured on shoot regeneration medium for 2-3 days during

which time the transfer of T-DNA along with foreign genes takes place. Subsequently the transformed tissue is transferred on selection medium supplemented with lethal doses of kanamycin to eliminate non transformed tissue. After 2-3 weeks transfer to root inducing media and another 3-4 weeks for plant hardening. 3

19. mRNA from cells are taken and reverse transcribed to c DNA using reverse transcriptase. The c DNA is labeled with red and green flours that serve as probes. They are placed on microarray. Two cDNA probes are tested by hybridizing them to DNA microarray. Observation of colored spots tells about genes expressed in different conditions. 3

OR

DNA chips are used in microarray technologies. It is a glass slide onto which DNA molecules are spotted as an array and can be hybridized to specific probes. This helps researchers to analyse interactions among thousands of genes simultaneously/ It helps to study tissue specific genes/ cell cycle variations *etc*. Pg. 69 3

20. It provides buffering / sterility of chamber / constant temperature / high relative humidity / maintains osmolarity as on pg.143. (any 3). 3

21. (a) A gene is made inactive by inserting a foreign DNA eg. Blue-white selection.
(b) Expression of LacZ in form of blue colonies, expression of GFP as fluorescent colonies or any other.

1+2

22. Fig 10 ,pg 45. Mass spectrometer consisting of an ionization chamber in which vaporized sample of a protein is introduced. The sample is ionized and charged molecules are then propelled into mass analyzer that separates ions according to m/z ratio.

It is used to obtain protein mass and sequence/ to identify type and location of amino acid modifications, *etc*. (Any one) 2+1

23. Fig.6 / pg 14.

Steps to be included
*Isolate vector and DNA fragment to be cloned.
*Separately digest them with the same restriction enzyme.
* The digested DNA fragment and vector are mixed in a suitable buffer and ligated. 3

24. 3

S. No.	**Batch culture**	**Continuous culture**
1.	Closed system	Open system
2.	All nutrients are in limited quantity.	One of the nutrients is in limited quantity and added before it is exhausted.

3.	Cell number decreases after a while due to depletion of nutrients & accumulation of toxic metabolites.	Cells can be grown at constant rate for extended period.
4.	Used for isolating intracellular metabolites.	For biomass and metabolite production.

Any 3 points. A graph indicating point 3 can be considered. 3

25. (a) Golden rice is enriched with pro vitamin A . It is transgenic for three genes for β-carotene synthesis that are expressed in the endosperm.
(b) Low cost / alleviation of storage problems / easy delivery system (oral).

(c) They require minimal inputs such as water, minerals, light and CO_2 for their growth. 3

26. Figs.13 and 14 pgs.23-26. 3

27. (a) Sickle cell anemia is called a molecular disease because it is due to a single amino acid substitution(valine for glutamic acid) in the 6^{th} position of the β-chain of hemoglobin molecule.
(b) Peptide mapping/protein fingerprinting as on pg. 36-37, fig.6

(c) V.M. Ingram 1+3+1

28. (a) To maintain optimal function of cellular enzymes / optimal binding of hormones and growth factors.
(b) Most biological processes are pH sensitive and therefore transient pH changes lead to cell death.
(c) Using buffering system: bicarbonate – CO_2 . The CO_2 derived from cells reacts with water to form carbonic acid that leads to a drop in pH. Bicarbonate in the medium neutralizes the effect of CO_2.

2 + 1+ 2

OR

(a). Domains/specific sequence within proteins that are recognized by specific antibodies.
(b) mAb are produced by antigen activated B-cells that have been immortalized by hybridizing with myeloma cells, using PEG. The hybrid cell retains the ability of B-cells to secrete antibodies and of the myeloma cell to divide indefinitely. The hybrid cell when grown in culture produces epitope specific antibodies. Pg.149, fig.7
(c) Herceptin, OKT-3, pg.150. 1+2+2