Question Booklet Series: **A** *Question Booklet Serial No.* 100012

Ph.D. Entrance Test – 2018

Subject: Stem Cell Tissue Engineering and Biomedical Excellence

Paper – I

Important: *Please consult your Admit Card/Roll No. slip before filling your Roll Number on the Test Booklet and Answer Sheet.*

Roll No. ***In Figure*** ***In Words***

O.M.R. Answer Sheet Serial No.

Signature of Candidate: _____ *Signature of Invigilator:* _____

Time: 60 Minutes **Number of Questions: 50** **Maximum Marks: 50**

DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO.

INSTRUCTIONS:

1. Write your Roll No. on the Questions Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Question Booklet Serial No. on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point/Black Gel Pen**.
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. Please check that this Question Booklet contains **50** Questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of Test.
5. Each question has four alternative answer (A,B,C,D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point/Black Gel Pen. There shall be no negative marking for wrong answers.**
6. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Booklet. No marks will be deducted in such cases.
7. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the question given in the Question Booklet.
8. If you want to change an already marked answer, erase the shade in the darkened bubble completely.
9. For rough work only the blank sheet at the end of the Question Booklet be used.
10. The Answer Sheet is designed for computer evaluation. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e. not following the instructions completely, shall be of the candidate only.**
11. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
12. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so would be expelled from the examination.
13. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistant or found giving or receiving assistant or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
14. **Communication equipment such as mobile phones, pager, wireless set, scanner, camera or any electronic/digital gadget etc., is not permitted inside the examination hall. Use of calculators is not allowed.**
15. The candidates will not be allowed to leave the Examination Hall/Room before the expiry of the allotted time.

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1. 1.5ml tissue cultured cells are seeded at the density of 80,000 cells/ml in a 6-well tissue culture plate. 0.3mM drug-X is found to induce differentiation. You are provided with 0.5ml of 0.05M drug-X. How much drug-X is added to cells for induction of differentiation?

A) 0.9µl
B) 9 µl
C) 6µl
D) 0.6µl

2. The junctions that are characterized by cytoplasmic intermediate filaments are
A) Both hemidesmosomes and desmosomes.
B) Desmosomes alone.
C) Adherence junctions alone.
D) Hemidesmosomes alone.

3. Cell adhesion molecules are involved in which type of interactions?
A) Intercellular interactions.
B) Cell-basement membrane interactions.
C) Cell-extracellular matrix interactions.
D) Intracellular interactions.

4. The murine embryonic stem cells if grown in medium supplemented with serum and leukemia inhibitory factor (LIF) will
A) Differentiate.
B) Not differentiate and become multipotent.
C) Retain self renewal & pluripotency.
D) Not retain self renewal.

5. The murine embryonic stem cells when grown in medium in the absence of serum and presence of LIF would undergo the following phenomenon
A) No growth.
B) Retain self-renewal & pluripotency.
C) Differentiation.
D) Proliferation and differentiation.

6. Feeder free culture of human embryonic stem cells while preserving embryonic stem cell features requires
A) Presence of feeders.
B) Absence of feeders and presence of substratum such as matrigel with 100% murine embryonic fibroblast (MEF) conditioned medium.
C) Absence of feeders and presence of serum alone in medium.
D) Absence of both feeders and substratum such as matrigel.

7. The typical marker expressed by murine embryonic stem cells is
A) TRA-1-81
B) SSEA-4
C) SSEA-1

D) SSEA-3

8. In order to meet the major objective for embryonic stem cell research i.e. the therapeutic transplantation, the human embryonic stem cells grown in feeder free culture are best if
   A) Cultured using conditioned medium form murine embryonic fibroblasts (MEF) supplemented with FCS (Fetal Calf Serum).
   B) Cultured using conditioned medium from murine embryonic fibroblast supplemented with Fetal Bovine Serum (FBS).
   C) Cultured using conditioned medium from human embryonic fibroblasts and FCS.
   D) Cultured using conditioned medium from human embryonic fibroblasts and human serum.

9. The process of immunosurgery used for isolating embryonic stem cells from blastocysts requires the treatment of blastocyst devoid of Zona Pellucida with anti-human whole serum antibodies followed by washing off any antibody residue. Subsequently blastocyst is incubated in medium containing guinea pig complement. The following is true.
   A) Antibodies bind to inner cell mass.
   B) Antibodies bind to guinea pig complement.
   C) Guinea pig complement binds to antibodies.
   D) Guinea pig complement binds to trophectoderm.

10. Which one of the followings is non-biodegradable material that has been used for making nerve conduits in nerve tissue engineering?
   A) Fibronectin
   B) Gelatin
   C) Chitosan
   D) Silicone

11. The conversion of cells of one organ into cells of another organ is termed as
   A) Dedifferentiation
   B) Metaplasia
   C) Differentiation
   D) Transdifferentiation

12. The *in vitro* assay to show that normal stem cells found in the subventricular zone of mice are capable of self-renewal, involves their ability to form
   A) Neurospheres
   B) Tumorospheres
   C) Neurons
   D) Glial Cells

13. The MHC haplotype of a mouse is $H2^{k/d}$. The types of class II MHC (IE) molecules expressed by liver hepatocytes of this strain are
   A) IE $\alpha^k\beta^d$ only.
   B) IE $\alpha^d\beta^k$ only.
   C) IE $\alpha^k\beta^k$ only.

D) No IE molecules.

14. The oligonucleotide complementary to the 3' end of variable domain of light chain is used as a probe for the restriction endonuclease digested DNA of B-cell and that of germ line cell in the southern blot hybridization assay. How many DNA bands get labeled with the probe in the autoradiograph?
A) One band for each B cell & germline cell.
B) One band for B cell & multiple bands for germline cell.
C) Multiple bands for B cell & one band for germline cell.
D) Multiple bands for each B and germline cell.

15. Monocytes originate from which type of progenitors?
A) Common lymphoid progenitors.
B) Common myeloid progenitors.
C) Hematopoietic stem cells.
D) Macrophages.

16. All except one nonstandard nucleotides are present in tRNA molecules.
A) Inosine.
B) Inositol.
C) Dihydrouridine.
D) Pseudouridine.

17. This assay is used for identifying the isotype of an antibody molecule.
A) Radial immunodiffusion assay.
B) Double immunodiffusion assay.
C) Immunoelectrophoresis.
D) Western Blot.

18. Affinity maturation of antibodies results from the phenomenon called
A) Multigene arrangement.
B) Alternative splicing.
C) Somatic Hypermutation.
D) Allelic exclusion.

19. The multiples of sarcomeres found in the skeletal muscle are known as
A) Myofiber.
B) Myofibril.
C) Microfilament.
D) Actin and myosin.

20. The membrane bilayer containing phosphatidylcholine in the outer leaflet and phosphatidylethanolamine in the cytosolic leaflet would be
A) flat.
B) curved.
C) cylindrical.

D) thick.

21. In sphingomyelin, the polar head group attached to the terminal hydroxyl group of sphingosine is
A) Phosphocholine.
B) Phosphatidylcholine.
C) Phosphosugar.
D) Sugar.

22. The detergent such as sodium dodecyl sulfate (SDS) has been used to isolate membrane protein. In this process, SDS causes denaturation of protein. This is because SDS is
A) Charged molecule.
B) Uncharged molecule.
C) Neutral molecule.
D) Non-Ionic molecule.

23. The resting membrane potential in animal cells is maintained by these ion channels.
A) Nongated Na^+ channels.
B) Voltage gated Na^+ channels.
C) Nongated K^+ channels.
D) Voltage gated K^+ channels.

24. GLUT4 is expressed in fat cells in the intracellular membrane. In the presence of glucose, GLUT4 causes glucose uptake by fat cells. This is possible only by increasing the GLUT4 on plasma membrane by fusion of GLUT4 rich internal membrane with plasma-membrane. Which signaling is responsible for this phenomenon?
A) Insulin dependent signaling leading to activation of protein kinase B (PKB).
B) Glucagon dependent signaling leading to activation of protein kinase B (PKB).
C) Insulin dependent signaling leading to activation of protein kinase C (PKC).
D) Insulin dependent signaling leading to activation of protein kinase A (PKA).

25. In mammalian subventricular zone, the neural stem cells are those which extend ____ through the ependymal cell layer into the ventricle.
A) Single cilium
B) Two cilia
C) Three cilia
D) Four cilia

26. The alkalization of parietal cells is prevented due to the presence of ____ in the ____ membrane.
A) H^+/K^+ ATPase, apical
B) H^+/K^+ ATPase, basolateral
C) Cl^-/HCO_3^- antiporter, apical
D) Cl^-/HCO_3^- antiporter, basolateral

27. Cl^-/HCO_3^- antiporter exports ____across the plasma membrane of animal cells.

A) HCO_3^- and imports Cl^-
B) Cl^- and imports HCO_3^-
C) Both Cl^- and HCO_3^-
D) ATP

28. The chemical stain such as hematoxylin is used for staining histological sections. It binds to the following molecules.
A) Neutral aminoacids only.
B) Both acidic aminoacids & DNA.
C) Basic aminoacids only.
D) Both basic aminoacids & DNA.

29. The vesicles composed of lipids such as phospholipids can be loaded with a protein such as glycophorin. Which compartment of these vesicles would contain this protein?
A) The bilayer.
B) The monolayer.
C) Interior core.
D) Both bilayer and interior core.

30. What happens to G-actin without a bound nucleotide (either ATP or ADP)?
A) It renatures.
B) It is stable.
C) It denatures.
D) It has stable α- helical structure.

31. Binding of profilin to G-actin leads to the following.
A) Exchange of ATP for ADP.
B) Exchange of ADP for ATP.
C) Exchange of GTP for GDP.
D) Exchange of GDP for GTP.

32. When soluble myosin-II is subjected to limited digestion with a protease chymotrypsin followed by papain then which fragments are generated at the end of digestion?
A) Heavy meromyosin.
B) Light meromyosin and S1 fragment.
C) S1 fragment & heavy meromyosin.
D) S1 and S2 fragments and light meromyosin.

33. The transverse tubule found in the myofiber is an extension of the following
A) Sarcoplasmic reticulum.
B) Sarcolemma.
C) Myofibrils.
D) Z-disk.

34. The retrograde transport of organelles within the cell is mediated mainly by these motor proteins.
A) (+) end directed kinesin
B) Kinesin-1
C) Cytoplasmic dynein
D) Kinesin-2

35. The 9+2 arrangement of microtubules in axonemes means that each axoneme contains
A) Nine doublet microtubules surrounding two central singlet microtubules.
B) Nine singlet microtubules surrounding two central singlet microtubules.
C) Nine doublet microtubules surrounding two central doublet microtubules.
D) Nine doublet microtubules surrounding three central doublet microtubules.

36. In Southern blot hybridization assay the DNA on the gel is converted into single stranded form by this reagent.
A) Acid.
B) Alkali.
C) Nitrocellulose.
D) Phosphate buffer pH7.0.

37. The following junctions are characterized by the presence of integrins.
A) Adherence junctions.
B) Desmosomes.
C) Hemidesmosomes.
D) Tight junctions.

38. The glomerular basement membrane in kidney is composed of
A) Plasma membrane.
B) Basal lamina.
C) Membrane of endothelial cells.
D) Membrane of epithelium that lines the urinary space.

39. The procollagen-α- chains contain propeptide sequence at their both N & C terminal ends. They associate laterally to form procollagen. What is the nature of procollagen?
A) Single triple helix.
B) Many triple helices held together.
C) Collagen fibrils.
D) Collagen fibers.

40. The hepatocytes are arranged as hepatic cords within each liver lobule. These are present in close proximity of either sides of the hepatic cords.
A) Sinusoids.
B) Basal lamina.
C) Space of Disse.
D) Fenestrated endothelium.

41. The single myofiber has been treated with anti-Pax7 fluorescent labeled antibody followed by counterstaining with DAPI. The results demonstrate that
A) Former experiment reveals both satellite cell and myofiber nuclei.
B) Latter experiment reveals both satellite cell and myofiber nuclei.
C) Latter experiment reveals only myofiber nuclei.
D) Former and latter experiments reveal only satellite cell nucleus.

42. What happens when the germ cells isolated from donor testes of male mice transgenic for *Rosa (lac Z)* are subjected to Ultraviolet radiations and subsequently microinjected in testes of *non-Rosa (lac Z)* recipient male mice that have been treated with testes specific chemotoxic agents. Few days later, the recipient mice are stained with X-Gal. What happens to donor cells?
A) Donor cells form blue coloured colonies in recipient mice.
B) Donor cells do not form any blue coloured colonies in recipient mice.
C) Donor cells produce complete spermatogenesis in recipient mice.
D) Donor cells contain spermatogonial stem cells.

43. The non-ciliated rounded secretary cells present within the bronchiole wall are known as
A) Cuboidal epithelial cells.
B) Clara cells.
C) Goblet cells.
D) Smooth muscle cells.

44. What happens to the mammary gland stem cells that have been grown on collagen coated plates in serum free growth conditions.
A) They form mammospheres.
B) They show self-renewal.
C) They form colonies containing myoepithelial cells surrounding a core of luminal cells.
D) They are unipotent.

45. The female flies that carry homozygous mutation for bicoid encoding gene will give rise to embryos with special features. These are
A) Embryos lack anterior body parts.
B) Embryos lack posterior body parts.
C) Embryos lack dorsal body parts.
D) Embryos lack ventral body parts.

46. The activated protein kinase A (PKA) phosphorylates glycogen synthase, an enzyme present in hepatocytes. What happens in this process?
A) Increased glycogen synthesis.
B) Inhibition of glycogen synthesis.
C) Inhibition of glycogen phosphorylase kinase.
D) Stimulation of glycogen synthase.

47. The rate of hydrolysis of GTP, by G_α protein is greater than that, by wild type Ras protein. This is due to the following reason.
A) Ras contains a constitutively active GTPase domain.
B) G_α contains a GAP (GTPase activating protein) domain.
C) GTP binding domain of both Ras and G_α have dissimilar structure.
D) Glycine-12 in Ras does not allow its binding to GAP.

48. What happens if the lysosomal proteases are released into the cytosol?
A) They actively digest nucleic acids.
B) They actively digest proteins.
C) They actively digest lipids.
D) They poorly digest cytosolic components.

49. In humans the fetus gets protected from antigens due to transcytosis of maternal antibodies across placenta. This has been attributed to the
A) Presence of Fc receptors on maternal cells in contact with fetal blood.
B) Presence of Fc receptors on fetal cells in contact with maternal circulation.
C) Absence of Fc receptors on fetal cells in contact with maternal circulation.
D) Absence of Fc receptors on maternal cells in contact with fetal circulation.

50. The functional bacterial IS element is composed of
A) Central region encoding a transposase flanked by two inverted repeats.
B) Region encoding transposase only.
C) Ac element flanked by inverted repeats.
D) Dc element flanked by inverted repeats.