Total Printed Pages : **16**

Booklet No.

M.Phil./Ph.D. ADMISSION TEST, 2018

Paper II

Subject : 104 - BIOTECHNOLOGY

Roll No. (In figures) .....(In words) .....

OMR Sheet Sr. No. .....

Signatures of Invigilators 1. ..... 2. .....

Names of Invigilators 1. ..... 2. .....

Time : 2 Hours

Max. Marks : 200

SEAL

GENERAL INSTRUCTIONS

1. Read the instructions given on the Question Booklet and OMR Sheet before starting the answers. All the entries should be filled by **blue or black ball point pen.**

2. The Question Booklet contains **100** questions and all questions are compulsory.

3. Each question is of **2** marks. There is **no negative marking.**

4. Candidates must ensure that the Question Booklet issued to them has all the questions. Defective Question Booklet can be got changed within **10** minutes.

1. प्रश्नों के उत्तर लिखने से पूर्व प्रश्न-पुस्तिका और ओ.एम.आर. शीट पर दिये हुए निर्देश पढ़ें। सभी प्रविष्टियाँ **नीले अथवा काले बॉल पॉइन्ट पेन** से भरें।

2. प्रश्न-पुस्तिका में **100** प्रश्न हैं और सभी प्रश्न अनिवार्य हैं।

3. प्रत्येक प्रश्न **2** अंक का है। कोई **नकारात्मक अंकन (negative marking) नहीं होगा।**

4. परीक्षार्थी सुनिश्चित कर लें कि उन्हें जो प्रश्न-पुस्तिका दी गई है उसमें सभी प्रश्न अंकित हैं। त्रुटिपूर्ण प्रश्न-पुस्तिका **10** मिनट की अवधि में बदलवाई जा सकती है।

5. In case of any discrepancy between English and Hindi versions of a question, English version will be taken as correct, wherever there are both versions.

5. किसी प्रश्न के अंग्रेजी और हिन्दी रूपान्तरणों में भिन्नता होने की स्थिति में अंग्रेजी रूपान्तरण सही माना जायेगा जहाँ प्रश्न-पत्र दोनों भाषाओं में है।

6. Select and darken the circle corresponding to the answer [(A) or (B) or (C) or (D)] in OMR sheet.

6. सही उत्तर का चयन करें तथा सम्बन्धित [(A) अथवा (B) अथवा (C) अथवा (D)] गोले को ओ.एम.आर. शीट में काला करें।

7. In case more than one circles are darkened in a question, it will not be evaluated.

7. किसी प्रश्न में एक से अधिक गोले को काला करने पर उसे जाँचा नहीं जायेगा।

8. Do not make any stray marks on OMR sheet and do not fold it.

8. ओ.एम.आर. शीट पर किसी तरह का चिह्न न बनायें और न ही उसे मोड़ें।

9. Any candidate found removing pages from the Question Booklet may be disqualified and prosecuted.

9. प्रश्न-पुस्तिका से पृष्ठ निकालते हुए पाये जाने पर परीक्षार्थी को अयोग्य घोषित किया जा सकता है और उसके विरुद्ध विधिक कार्यवाही भी की जा सकती है।

10. Use of unfair means will disqualify the candidate from the examination.

10. अनुचित साधनों का उपयोग करने पर परीक्षार्थी को परीक्षा के लिए अयोग्य घोषित कर दिया जायेगा।

11. Cell phone, calculator or any such devices are not allowed in the Examination Hall.

11. सेलफोन, संगणक और ऐसी किसी भी अन्य प्रविधियों को परीक्षा भवन में लाने की अनुमति नहीं है।

12. No candidate is allowed to leave the seat before handing over the original OMR sheet to the invigilator. Candidate can take Question Booklet and Carbon copy of OMR sheet.

12. ओ.एम.आर. शीट की मूल प्रति वीक्षक को सुपुर्द किये बिना किसी भी परीक्षार्थी को अपना स्थान छोड़ने की अनुमति नहीं है। परीक्षार्थी प्रश्न-पुस्तिका एवं ओ.एम.आर. शीट की कार्बन प्रति को अपने साथ ले जा सकेगा।

1. The fluid mosaic model of plasma membrane was given by :

(A) Danielli and Davson

(B) J.D. Robertson

(C) Singer and Nicolson

(D) Gorter and Grandel

2. Lysosomes are the :

(A) Digestive centres

(B) Respiratory centres

(C) Excretory centres

(D) Energy centres

3. Which of the following organelle responsible in the synthesis and transport of liquid membrane protein ?

(A) Golgi apparatus

(B) Endoplasmic reticulum

(C) Lysosome

(D) Peroxisome

4. Which type of DNA Polymerase is **not** involved in the replication process of E. Coli ?

(A) DNA Polymerase I

(B) DNA Polymerase II

(C) DNA Polymerase III

(D) DNA Polymerase IV

5. Number of antigen binding site in IgM :

(A) 5

(B) 8

(C) 4

(D) 10

6. In eukaryotes, RNA primers are removed after replication by :

(A) Helicase

(B) FEN - 1

(C) Ligase

(D) DNA Polymerase

7. Which RNA Polymerase is responsible for the synthesis of mRNA ?

(A) RNA Polymerase I

(B) RNA Polymerase II

(C) RNA Polymerase III

(D) RNA Polymerase IV

8. The prokaryotic RNA Polymerase has the subunit structure :

(A) $\alpha\alpha\beta\beta\omega$

(B) $\alpha\beta\sigma$

(C) $\alpha\beta$

(D) $\alpha\beta\Psi$

9. Which of the following is **not** post-transcriptional modification ?

(A) Splicing

(B) 5' capping

(C) Glycosylation

(D) Adenylation

10. EF-T_u is an example of :

(A) An elongation factor

(B) A termination factor

(C) An anticodon

(D) An enzyme

11. Chloramphenicol inhibits :

(A) Cell wall synthesis

(B) DNA replication

(C) Protein synthesis

(D) Transcription

12. The oncogene is a mutated form of a normal cellular gene which codes for a :

(A) RNA

(B) Protein

(C) Carbohydrate

(D) DNA

13. The pre-dominant antibody in saliva is :

(A) IgG

(B) IgA

(C) IgM

(D) IgD

14. Allergy and Anaphylaxis are due to :

(A) IgE

(B) IgA

(C) IgG

(D) IgM

15. Extra-nuclear genetic material is found in :

(A) Ribosome

(B) Chloroplast

(C) Endoplasmic reticulum

(D) Centriole

16. Reverse transcriptase has both ribonuclease and polymerase activities. Ribonuclease activity is required for :

(A) The synthesis of new RNA strand

(B) The degradation of RNA strand

(C) The synthesis of new DNA strand

(D) The degradation of DNA strand

17. Potato virus X is a causal organism of :

(A) Mild mosaic of potato

(B) Leaf roll of potato

(C) Rugose mosaic of potato

(D) Crinkle of potato

18. Which of the following is **not** a viral disease of sugarcane ?

(A) Fiji diseases

(B) Chlorotic streak

(C) Mosaic disease

(D) Red rot

19. Human mitochondria :

(A) Are inherited as an X-linked trait

(B) Are all inherited from father

(C) Have linear DNA

(D) Are all inherited from mother

20. Isotopes used for proving semi-conservative replication of DNA are :

(A) N^{14} and N^{15}

(B) N^{14} and P^{31}

(C) N^{14} and C^{14}

(D) C^{14} and P^{31}

21. Which of the following transcription factors binds to TATA box ?

(A) TFII D

(B) TFII B

(C) TFIII A

(D) TFII E

22. 'KOZAK' is associated with :

(A) Transcription

(B) DNA repair

(C) Translation

(D) Replication

23. Crossing over occurs during :

(A) Cytokinesis

(B) Metaphase - I

(C) Prophase - II

(D) Prophase - I

24. If a guanine is lost from DNA due to hydrolysis of the glycosidic bond, this is repaired by :

(A) Base excision repair

(B) Purine salvage pathway

(C) DNA polymerase adding the guanine back by forming a new glycosidic bond

(D) Nucleotide excision repair

25. Gametogenesis is related to :

(A) Gemma formation

(B) Sporulation

(C) Gamete formation

(D) Parthenogenesis

26. Role of serum and other supplements in cell culture systems :

(A) Provide essential nutrients

(B) Acts as a detoxificants

(C) Determine the phenotype of cells

(D) All of the above

27. Which of the following virus contains single stranded DNA ?

(A) Φ X174 virus

(B) Cauliflower mosaic virus

(C) Herpes viruses

(D) Papilloma viruses

28. Yeast Artificial Chromosome (YAC) was first developed by :

(A) Watson and Crick

(B) D. Burke, G. Carle and M. Olson

(C) G. Haberlendt

(D) T. H. Morgan

29. Surface bound receptor proteins are characteristic feature of :

(A) B-cells

(B) Plasma cells

(C) T-cells

(D) None of the above

30. Electron from NADH enter the mitochondrial electron transport chain at the level of :

(A) Co-enzyme Q

(B) NADH - Q reductase (Complex I)

(C) CoH_2 - Cytochrome C reductase (Complex III)

(D) Cytochrome C oxidase (Complex IV)

31. What is the fundamental tool in immunofluorescence testing ?

(A) Specific antigen

(B) Red blood cells

(C) Fluorescent monoclonal antibody

(D) Fluorescent polyclonal antibody

32. The p53 protein normally promotes :

(A) DNA repair

(B) Cell division

(C) Tumor formation

(D) Apoptosis

33. X - ray diffraction is a analytical technique for examining :

(A) Crystalline solid

(B) Liquid

(C) Powder

(D) Gases

34. In PCR used for site-directed mutagenesis, _____ DNA polymerase is **not** preferred.

(A) Pfu

(B) Vent

(C) Phusion

(D) Taq

35. Which one of the following is **not** a reducing sugar ?

(A) Maltose

(B) Lactose

(C) Sucrose

(D) Fructose

36. Amongst the following, which is the achiral amino acid ?

(A) Lysine

(B) Glycine

(C) Serine

(D) Alanine

37. Glucokinase phosphorylates glucose at higher blood glucose concentration than hexokinase, which implies that :

(A) Glucokinase has higher affinity for glucose than hexokinase.

(B) Insulin induces hexokinase rather than glucokinase to control increased blood sugar levels.

(C) Hexokinase responds quickly to blood glucose levels after a carbohydrate-rich meal (fed-state).

(D) Glucokinase has a higher K_m than Hexokinase.

38. Ultrafiltration of the media with 0.2 μm filters is not an effective method to get rid of _____ contamination.

(A) *Saccharomyces cerevisiae*

(B) *Mycobacterium tuberculosis*

(C) *Mycoplasma pneumoniae*

(D) *Plasmodium falcipuram*

39. Nosocomial infections are the infections _____.

(A) contracted through air-borne particle inhaled through nose

(B) contracted through any means from the hospital environment

(C) that damage the nasal cavity of the host

(D) that damage the nose and ear epithelia

40. The isoelectric pH of lysine is (pK_a of α-$CO_2H = 2.18$, pK_a of α-$NH_3^+ = 8.95$, pK_a of side chain = 10.53)

(A) 8.95

(B) 9.74

(C) 10.53

(D) 7.22

41. Which of the following pairs is **mismatched** ?

(A) Spliceosome - removal of introns

(B) Transposase - insertion of DNA segments into DNA

(C) DNA ligase - joins segments of DNA

(D) RNA polymerase - makes a molecule of RNAfrom an RNA templatein eukaryotes

42. If an aerobic organism (e.g., the bacterium *E. coli*) were fed each of the following four compounds as a source of energy, the energy yield per mole from these molecules would be in the order :

(A) Alanine > glucose > palmitate

(B) Glucose > alanine > palmitate

(C) Glucose > palmitate > alanine

(D) Palmitate > glucose > alanine

43. When a bacterium such as *E. coli* is shifted from a warmer growth temperature to a cooler growth temperature, it compensates by :

(A) Increasing its metabolic rate to generate more heat

(B) Putting longer-chain fatty acids into its membranes

(C) Putting more unsaturated fatty acids into its membranes

(D) Synthesizing thicker membranes to insulate the cell

44. Movement of DNA from one bacteria to another through a tubular bridge or pilus is :

(A) Conjugation

(B) Transposition

(C) Transfection

(D) Transduction

45. Q - fever pneumonia causing organism _____ that can cause meningitis or endocarditis.

(A) *Coxiella burnetti*

(B) *Legionella sp.*

(C) *Aspergillus niger*

(D) *Klebsiella pneumonia*

46. What is Archaea ?

(A) A classification for organisms that have two nuclei

(B) A classification for organisms that use phagocytosis

(C) A classification of an organism that identifies prokaryotes that do not have peptidoglycan cell walls

(D) A classification of an organism that identifies prokaryotes that have peptidoglycan cell walls

47. The primary RNA transcript of the chicken ovalbumin gene is 7700 nucleotides long, but the mature mRNA that is translated on the ribosome is 1872 nucleotides long. This size difference occurs mainly as a result of :

(A) Capping

(B) Removal of Poly - A tail

(C) Splicing

(D) None of these

48. In prokaryotes during replication, the lagging strand is synthesized in a series of short fragments known as Okazaki fragments, consequently requiring many primers. The RNA primers of Okazaki fragments are subsequently degraded by DNA Polymerase I and the gaps are filled. How does DNA polymerase I fill the gaps once the primer have been removed from lagging strand ?

(A) DNA polymerase I has its own primer

(B) DNA polymerase I do not require primer

(C) DNA from leading strand serves as primer

(D) Ends of existing Okazaki fragments on lagging strand serves as primer

49. Too much time in sun tanning probably causes DNA damage to epithelial cells. The most likely effect would be :

(A) Depurination

(B) Pyrimidine Dimers

(C) Deamination

(D) Single-stranded nicks in the phosphodiester backbone

50. Which of the following primers would allow copying of the single stranded DNA sequence 5' ATGAATAGGTC ?

(A) 5' ATGAA

(B) 5' TACTTA

(C) 5' CTGGA

(D) 5' GACCT

51. Two molecule of DNA cut by 2 restriction enzymes which cut as shown 5' G'GATCC and 5' TTT'AAA can be :

(A) Never joined

(B) Always joined

(C) Joined after special enzymatic reaction

(D) None of these

52. Terminal transferase is an enzyme which is considered to be a :

(A) Template independent polymerase

(B) Template dependent polymerase

(C) Restriction endonuclease

(D) All of these

53. In cesium chloride gradient used in plasmid extraction, RNA is seen as :

(A) A pellet at the bottom of the tube

(B) Just above the plasmid band

(C) At the top of the gradient

(D) Just beneath the protein layer

54. C_T during real time PCR refers to :

(A) Timing cycle

(B) Target cycle

(C) Threshold cycle

(D) None of these

55. Inverse PCR allows :

(A) Amplification of regions outside a known sequence

(B) Amplification inside a known sequence

(C) Amplification in an unknown reverse manner

(D) Deletion of a known sequence

56. Which is **not correct** regarding "BLAST" algorithm ?

(A) It is a local alignment algorithm

(B) It is a deterministic algorithm

(C) It is a pair-wise alignment algorithm

(D) It is generally used for database search

57. Homology modelling is a procedure where by :

(A) Due to low sequence similarity between proteins of unknown and known structure, the structure is predicted from first principles

(B) Due to high sequence similarity between proteins of unknown and known structure, the same function is assumed for both

(C) Due to high sequence similarity between proteins of unknown and known structure, the structure of the latter is used as a template to model the former

(D) A protein of unknown structure is compared against a library of fold templates to find the best match

58. _____ is essential during phylogenetic tree construction.

(A) Pair-wise sequence alignment

(B) Secondary structure prediction

(C) GC content of gene

(D) Multiple sequence alignment

59. H_2O_2 produced in aerobic bacteria get dissipated by following enzyme(s) :

(A) Superoxide dismutase

(B) Peroxidase

(C) Catalase

(D) Both (B) and (C)

60. Following is an example of selective - differential media :

(A) Nutrient agar

(B) Potato Dextrose Agar

(C) MacConkey agar

(D) Nutrient Broth

61. Following rings are absent in gram positive bacterial flagella :

(A) L and P

(B) S and M

(C) L and S

(D) P and S

62. Following are the semi-rigid extension of cell wall, which increases the surface area of bacterial cell for nutrient absorption :

(A) Flagella

(B) Axile filament

(C) Pili

(D) Prosthecae

63. Following is **not** a type of fungal sexual spore :

(A) Basidiospore

(B) Zygospore

(C) Oospore

(D) Conidiospore

64. Biolog test identify the bacteria by their ability to use following sources :

(A) Nitrogen

(B) Carbon

(C) Oxygen

(D) Fatty Acid

65. Below its pI, a protein become :

(A) Negatively charged

(B) Positively charge

(C) Zwitter ion

(D) Precipitates

66. Two enzymes X and Y catalyze the same reaction. X has a higher K_m. Which enzyme requires less substrate to get to $V_{max}/2$?

(A) X

(B) Y

(C) Both requires the same

(D) Data is insufficient

67. Select most appropriate statement.

(A) If the fossil record were complete, we could conclude that the last common ancestor of plants and animals was unicellular organism. But it is far from complete.

(B) Analysis of organelle genomes adds some details, because the endosymbiotic events that established mitochondria and chloroplasts bracket the time of the last common plant/animal ancestor. Sometime after the appearance of the first eukaryotes, but before the last common ancestor of plants and animals, the uptake of the alpha proteobacterium that led to mitochondria occurred ; the evidence for this timing is the clear homology of the mitochondrial genomes in plants and animals.

(C) After the last common ancestor of plants and animals, another endosymbiotic event, the uptake of a cyanobacterium to form the precursor of chloroplasts, occurred only in the plant lineage. Therefore, the last common ancestor of plants and animals lived after the alpha-proteobacterial uptake, and before the cyanobacterial. It is simplest to imagine that both uptake events occurred in unicellular eukaryotes, but this is hardly proof that the last common ancestor of the plant and animal lineages was in fact unicellular.

(D) All of the above.

68. Successful attempts were made through anther culture for production of haploid plants by :

(A) P. Maheshwari

(B) S.S. Bhojwani

(C) B.M. Johri

(D) Satish C. Maheshwari

69. Haberlandt's dream of producing a whole plant from a single isolated cell (thus demonstrating totipotency of plant cells) was realized in 1965 by :

(A) Vasil, I.K. and Hildebrandt, A.C.

(B) Vasil, Vimla. and Hildebrandt, A.C.

(C) Steward, F.C., Mapes, M.O., and Mears, K.

(D) Reinert, J.

70. Monocots are difficult to grow in vitro. Applications of plant tissue culture technology in cereal/palms and grasses were slow. The use of synthetic auxin(s) in culture media helped the tissue culturist. Successes were made. The synthetic auxin used was/is :

(A) IPA

(B) NAA

(C) 2, 4-Dichlophenoxy acetic acid (2, 4-D)

(D) TIBA

71. Transplastomic plants are produced by :

(A) Transfer of plastids of one species to the other

(B) Genetic transfer of foreign gene to plastome (plastid transformation) using particle gun technology

(C) Genetic transfer of foreign gene into plastome and mitochondrial genomes

(D) Fusion of Enucleated protoplast with nucleated protoplasts by electro fusion

72. Polymerase Chain Reaction (PCR) was improved/ brought in practice by :

(A) Kary Banks Mullis

(B) K. Kleppe and H.G. Khorana

(C) Michael Smith

(D) H.G. Khorana

73. One of the following is not PCR-based molecular markers :

(A) SSR

(B) RAPD

(C) RFLP

(D) VNTR

74. Clonal Population of plants regenerated from single-leaf cell protoplasts are important sources of useful resources for crop improvement. These are described as :

(A) Protoplast derived mutants

(B) Gametoclonal variations

(C) Protoclonal variations

(D) Somatic cell mutants

75. Animal cell culture was first successfully undertaken by :

(A) Ross Harrison in 1907

(B) G. Haberlandt, a German in 1902

(C) G.M. Morel

(D) PR White in 1934

76. Find **wrong** statement.

Chaim Weizmann, the first president of Israel.

(A) Discovered in 1912, of a way of making alcohol from the starch in cereal grains may well have saved his adopted country - the Britain from defeat.

(B) The Weizmann process changed everything, he relied on the use of the bacterium *Clostridium acetobutylicum* (known as the Weizmann organism), for fermentation.

(C) By 1917, his process was producing acetone at a rate of almost 3000 tons a year at the Royal Navy Cordite Factory at Holton Heath, Dorset, and other sites in Britain.

(D) In scientific circles, Weizmann became known as the father of industrial fermentation. He played a key role in discussions with the British government that led to the Balfour Declaration in November 1917, which recommended the establishment of a national home for the Jewish people in Palestine.

77. The practice of dehorning is common in dairy production as it helps prevent injuries to both cattle and animal handlers. However, dehorning can cause discomfort and pain to cattle. It also requires additional labor to dehorn cattle.

Dehorning/eliminating the horn could soon be a thing of the past as it is possible to create hornless animals through :

(A) RNA editing

(B) Livestock genetic editing/genome editing

(C) Nutrition management

(D) Genome sequencing

78. In science history, in 1981, saw the issuing of a, for a genetically modified *Pseudomonas* bacterium that would eat up oil spills, the first patent of its kind on life forms :

(A) Ananda Mohan Chakrabarty for an organism that had been genetically modified.

(B) Sidney A Diamond

(C) Both of the above

(D) None of the above

79. Select **incorrect** statement.

In-Vitro meat is the (idea of) manufacturing of meat products through "tissue-engineering" technology.

(A) Cultured meat (= in-vitro meat = clean meat) could have financial, health, animal welfare and environmental advantages over traditional meat.

(B) The idea : To produce animal meat, but without using an animal. Starting cells are taken painlessly from live animals, they are put into a culture media where they start to proliferate and grow, independently from the animal.

(C) Theoretically, this process would be efficient enough to supply the global demand for meat. All this would happen without any genetic manipulation, i.e. without the need to interfere with the cells' genetic sequences.

(D) Producing cultured meat for processed meat products, such as sausages, burgers and nuggets should be comparatively simple. However, practically it is impossible to produce meat in vitro.

80. A wall-less, unicellular halotolerant microalga that survives in harsh environments such as high salinity, high irradiance, low temperature, and under macro and micronutrient limitations. This inhabits hypersaline Sambhar Lake and can grow optimally at 0.5 M NaCl and 16:8 h L:D photoperiod along with maintaining low level of intracellular Na^+ even at higher salinity, emphasizing special features of its cell membranes. This accumulates a large amount of Beta-carotene and glycerol in the cells under specific conditions. The organism is :

(A) *Dunaliella salina*

(B) *Physcomitrella patens*

(C) *Nannochloropsis sp.*

(D) *Chlamydomonas raudensis*

81. Select the **correct** statement.

GM potato rich in protein is developed by Indian scientists. The research is published in *Proceedings of the National Academy of Sciences* (PNAS) of USA.

(A) This genetically modified potato is named "Protato" which contains 60% increase in total protein content. It is developed by introducing *AmA1* gene (Amaranth Albumin 1) from edible amaranth plant into seven commercial varieties of potatoes.

(B) It has genes introduced from an animal source.

(C) The technology is developed with the help of USA.

(D) The GM potato is named as topato.

82. The use of high-voltage electric shocks to introduce DNA into cells - is a procedure that is gaining in popularity for standard gene transfer and also allows the generation of genetically modified mice. It can be used with most cell types, yields a high frequency of both stable transformation and transient gene expression and because it requires fewer steps, can be easier than alternate techniques. Protocols for it are defined. The techniques called as :

(A) Electrofusion

(B) Electroporation

(C) Electro-induction

(D) Electro-infection

83. Cybrids are valuable tools as :

(A) Cytoplasmic hybrid (cybrid) cell lines can incorporate human subject mitochondria and perpetuate its mi-tochondrial DNA (mtDNA)-encoded components. Since the nuclear background of different cybrid lines can be kept constant, this technique allows investigators to study the influence of mtDNA on cell function.

(B) Cybrid plants can be produced by mass fusion of plasmolytically induced cytoplasts with protoplasts.

(C) These *(cybrid)* are *cell(s)* harboring a nuclear genome of a given species *(the recipient)* but containing an alien chloroplast genome (plastome) and/or a mitochondrial genome (chondriome) that is partially or totally alien (from the donor fusion-partner).

(D) All of the above.

84. Scientist associated with Golden Rice technology :

(A) Norman Borlaug

(B) Ingo Potrykus

(C) G.S. Khush

(D) M.S. Swaminathan

85. Edward Jenner developed :

(A) A vaccine for smallpox

(B) A vaccine for T.B.

(C) A vaccine for typhoid

(D) A cell culture method

86. Select the **incorrect** statement.

The Asilomar Conference on Recombinant DNA was an influential conference organized in February, 1975.

(A) To discuss the potential biohazards and regulation of biotechnology.

(B) A group of about 140 professionals (primarily biologists, but also including lawyers and physicians) participated in the conference to draw up voluntary guidelines to ensure the safety of recombinant DNA technology.

(C) The effects of the guidelines framed in the conference are still being felt through the biotechnology industry and the participation of the general public in scientific discourse.

(D) The effects of the guidelines framed in the conference in 1975 are irrelevant in era of genomics and genome/gene editing.

87. Genome editing technologies include :

(A) Such as the CRISPR-Cas9 system, TAL effectors and Zinc-Finger Nucleases (ZFNs).

(B) Genome/protein sequencing

(C) Antisense technologies

(D) Inbreeding of populations

88. A HANDBOOK OF PLANT TISSUE CULTURE (THE JAQUES CATTELL PRESS LANCASTER, PENNSYLVANIA) 1943 was authored by :

(A) R.J. Gautheret

(B) A.C. Hildebrandt

(C) PHILIP R. WHITE

(D) A.D. Krikorian

89. Somatic hybrids of potato and tomato regenerated from fused protoplasts were produced by :

(A) E.C. Cocking

(B) Peter S. CARLSON, H.H. SMITH and R.D. DEARING

(C) Georg MELCHERS, D. SACRISTAN and ANTHONY A. HOLDER in 1978

(D) James F. Shepard

90. Select **incorrect** statement(s).

HeLa cells – the first continuous cancer cell line – have been a mainstay of cancer research ever since their isolation from the aggressive glandular cervical cancer than 50 years ago. Knowledge of almost every process that occurs in human cells has been obtained using HeLa cells and other cell types from other sources.

(A) Free and informed consent of participants in research studies is a cornerstone of biomedical research, but this has not always been the case.

(B) HeLa Cells derived from tumor tissue of an American woman with her consent more than 60 years ago.

(C) Named HeLa cells were eventually identified as belonging to Henrietta Lacks, a fact that became widely known in 2010 upon publication of a bestselling book by Skloot in 2009 about the woman and her cellular legacy.

(D) However, 20 years after Henrietta Lacks death, mounting evidence suggested that HeLa cells contaminated and overgrew other cell lines. The debate over cell culture contamination began in the 1970s and was not harmonious.

91. Kaani tribe of Kerala and their Intellectual Property Rights (IPRs) are associated with :

(A) Agast-Hymalai hills of the Western Ghats

(B) Plant species *Trichopus zeylanicus*

(C) A process for preparation of an antidiabetic drug from the plant *Withania somnifera*

(D) Antibacterial and antifungal substances

92. A *photobioreactor* (PBR) incorporates some type of light source that may be natural sunlight or artificial illumination.

(A) Virtually any translucent container could be called a PBR, however the term is more commonly used to define a closed system, as opposed to an open storage tank or pond.

(B) Photobioreactors are used to grow small phototrophic organisms such as cyanobacteria, algae, or moss plants. These organisms use light through photosynthesis as their energy source and do not require sugars or lipids as energy source.

(C) Consequently, risk of contamination with other organisms like bacteria or fungi is very high in photobioreactors when compared to bioreactors for heterotroph organisms.

(D) Both (A) and (B).

93. Though there are several methods or techniques of preservation of industrially useful organisms :

(A) Repeated Sub-Culturing/culturing

(B) Storage (i) under Liquid Nitrogen (ii) in Mineral Oil (iii) in soil (iv) Silica Gel Storage or (v) Employment of Dried Cultures or Lyophilization

(C) Both (A) and (B)

(D) None of the above

94. The types of bioreactors are :

(A) Continuous Stirred Tank Bioreactors/Bubble Column Bioreactors/Fluidized Bed Bioreactors/Packed Bed Bioreactors

(B) Photo-Bioreactors

(C) Airlift Bioreactors

(D) All of the above

95. A polyextremophile gram-positive bacterium listed in *Guinness Book of World Records* as "the world's toughest bacterium." This can survive drought, lack of nutrients and most important, a thousand times more radiation than human and withstands harsh conditions of real and simulated outer space environment, e.g., UV and ionizing radiation. The name means 'strange berry that withstands radiation,' is the most radiation-resistant organism known. It was discovered in ground meat that spoiled despite having been sterilized by radiation. The microbe can be used cleaning up toxic waste. The organism is :

(A) *Deinococcus radiodurans*

(B) *Thiomargarita namibiensis*

(C) *Epulopiscium fishelsoni*

(D) *Nasuia deltocephalinicola*

96. Shikonin and its derivatives, red naphthoquinones-the alkanets are found in plants. These are produced in nature and also via biotechnology in cultures and through hairy root cultures :

(A) These are produced by whole plants of Boraginaceae.

(B) These are produced in roots of *Lithospermum erythrorhizon, Arnebia hispidissima* (found in Rajasthan) and Echium species.

(C) These are used as natural dyes and herbal medicines for centuries.

(D) Both (B) and (C).

97. Select **inappropriate** statement.

Currently, the global production of plastics exceeds 320 million tonnes (Mt) per year, with production expected to double in the next 20 years. By 2050, an additional 33 billion tonnes of plastic is estimated to be introduced into the planet. Of this, only 6 - 26% is recycled, meaning up to 94% ends up in landfills (21 - 42%) or released into the environment due to mismanagement through a variety of pathways.

(A) With the widespread use of different plastics, the current era has been referred to as the Plasticene. Plastic debris has been detected in air, oceans, soils, sediments and surface waters worldwide.

(B) Microplastics (plastics < 5 mm diameter, the MP) are at the forefront of current environmental pollution. Under acute conditions physical size alteration of microplastics ingested by a planktonic crustacean occur and ingested microplastics (31.5 μm) are fragmented smaller than 1 μm in diameter.

(C) Degradation of plastics leads from macro to micro and to even nano - sized particles. Microplastic, Nano - Plastics (NP) are also intentionally manufactured for cosmetic products, printer ink for three dimensional printers.

(D) There is no potential environmental risks from MPs and NPs.

98. Traditional healers recommend the insect - fungus/ mushroom for "all illnesses" as a tonic, because they claim that it improves energy, appetite, stamina, libido, endurance, and sleeping patterns. It is a rare combination of a caterpillar and fungus found at altitudes above 3,800 m. The system :

(A) Entomophagous *Ophiocordyceps sinensis* (syn. *Cordyceps sinensis*).

(B) Morel, *Morchella* species (Guchhi)

(C) *Agaricus* and *Pleurotus* sp. (Basidiomycetes)

(D) Truffles are ascomycetes fungi belonging to the genus *Tuber* species

99. The isolation of bacterial and fungal protoplasts following the use of enzymes digesting the cell wall suggested that protoplasts might be obtained from plant cells by treatment with fungal cellulase obtained from *Myrothecium verrucaria*. Protoplasts were isolated from Root tips of tomato seedlings were selected for investigation by :

(A) Michael R. Davey

(B) J. Brian Power

(C) Edward C. Cocking

(D) I. Takebe

100. Select **incorrect** statement(s).

The term 'Single Cell Protein (SCP)' was first introduced in 1968 at the Massachusetts Institute of Technology (MIT) in a meeting to find th alternate of most commonly used terms i.e. petroprotein and microbial protein.

(A) Single Cell Protein (SCP), i.e., protein produced in bacterial/microbial and fungal cells are involved in production of SCP.

(B) Much of the recent interest in SCP has focused on the valorisation of side streams by using microorganisms to improve their protein content, which can then be used in animal feed.

(C) In recent years, the versatile phototrophic protist *Euglena gracilis* has emerged as an interesting candidate for application-driven research and commercialisation, as it is an excellent source of dietary protein, pro (vitamins), lipids, and the β-1, 3-glucan paramylon only found in euglenoids.

(D) *Spirulina* (blue-green algae) is one of the cheapest sources of protein and essential vitamins. However, bitterness and bad flavour of spirulina protein do not allow its use in food products and protein delivery for human use.

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