



Previous Year Question Paper  
of

**JNU**

**Ph.D. / M.Phil. Entrance Test**  
**LIFE SCIENCES**

**2013**

**(Jawaharlal Nehru University)**



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62

QUESTION PAPER  
SERIES CODE

A

Registration No. :

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Centre of Exam. :

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Name of Candidate :

\_\_\_\_\_

Signature of Invigilator

**ENTRANCE EXAMINATION, 2013**

M.Phil./Ph.D. LIFE SCIENCES

[ Field of Study Code : SLSP (159) ]

Time Allowed : 3 hours

Maximum Marks : 70

**INSTRUCTIONS FOR CANDIDATES**

Candidates must read carefully the following instructions before attempting the Question Paper :

- (i) Write your Name and Registration Number in the space provided for the purpose on the top of this Question Paper and in the Answer Sheet.
- (ii) **Please darken the appropriate Circle of Question Paper Series Code on the Answer Sheet.**
- (iii) The Question Paper is divided into two parts : Part—A and Part—B. Choose the most appropriate answer.
- (iv) Answer *all* 30 questions of Part—A.
- (v) Answer *any* 40 questions from Part—B. If you answer more than 40 questions, only first 40 will be checked. **Questions covering both Biological Sciences and Physical Sciences are included. Therefore, it is advised that you read the entire Question Paper.**
- (vi) Each correct answer carries **one** mark. **For every wrong answer, half mark will be deducted.**
- (vii) Both parts have multiple choice questions. All answers are to be entered in the Answer Sheet provided with the question paper for the purpose by darkening the correct choice, i.e., (a) or (b) or (c) or (d) with **BALLPOINT PEN** only against each question in the corresponding circle.
- (viii) Calculators and Log Tables may be used.
- (ix) Answer written by the candidates inside the Question Paper will not be evaluated.
- (x) Two Pages at the end have been provided for Rough Work.
- (xi) Return the Question Paper and Answer Sheet to the Invigilator at the end of the Entrance Examination.
- (xii) **DO NOT FOLD THE ANSWER SHEET.**

**INSTRUCTIONS FOR MARKING ANSWERS**

1. Use only Blue/Black Ballpoint Pen (do not use pencil) to darken the appropriate Circle.
2. Please darken the whole Circle.
3. Darken ONLY ONE CIRCLE for each question as shown in example below :

|             |             |             |             |                 |
|-------------|-------------|-------------|-------------|-----------------|
| Wrong       | Wrong       | Wrong       | Wrong       | Correct         |
| ● (b) (c) ● | ⊗ (b) (c) ⊗ | ⊗ (b) (c) ⊗ | ● (b) (c) ● | ● (a) (b) (c) ● |

4. Once marked, no change in the answer is allowed.
5. Please do not make any stray marks on the Answer Sheet.
6. Please don't do any rough work on the Answer Sheet.
7. Mark your answer only in the appropriate space against the number corresponding to the question.
8. **Ensure that you have darkened the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

## PART—A

Answer **all** questions

- After four cycles of PCR reaction, each molecule of a duplex DNA will give rise to
  - 16 double-stranded DNA
  - 16 single strands of DNA
  - 32 single strands of DNA
  - 32 double-stranded DNA
- Each cycle of  $\beta$ -oxidation will produce
  - 1  $\text{FADH}_2$ , 1  $\text{NAD}^+$  and 1 acetyl-CoA
  - 1  $\text{FADH}_2$ , 1  $\text{NADH}$  and 2  $\text{CO}_2$  molecules
  - 1  $\text{FADH}_2$ , 1  $\text{NADH}$  and 1 acetyl-CoA
  - 1  $\text{FAD}$ , 1  $\text{NAD}^+$  and 2  $\text{CO}_2$  molecules
- The Duchenne muscular dystrophy (DMD) is an X-linked disease. A woman whose father was DMD-affected marries a normal man. What proportion of sons of this couple is expected to be affected?
  - $\frac{1}{4}$
  - $\frac{1}{8}$
  - $\frac{1}{2}$
  - $\frac{1}{16}$
- Which one of the following **does not** possess introns?
  - DNA
  - Processed mRNA
  - Non-processed pseudogenes
  - Primary RNA transcript
- The overall reaction for microbial conversion of glucose to glutamic acid is
$$\text{C}_6\text{H}_{12}\text{O}_6 + \text{NH}_3 + \frac{3}{2} \text{O}_2 \rightarrow \text{C}_5\text{H}_9\text{NO}_4 + \text{CO}_2 + 3\text{H}_2\text{O}$$
What mass of  $\text{O}_2$  will be required to produce 15 g of glutamic acid?
  - 5.3 g of  $\text{O}_2$
  - 4.9 g of  $\text{O}_2$
  - 4.5 g of  $\text{O}_2$
  - 5.8 g of  $\text{O}_2$

6. The 'Wobble hypothesis' refers to the less stringent base pairing specificity of the
- (a) 5'-end base of the codon
  - (b) 3'-end base of the anticodon
  - (c) middle base of the codon
  - (d) 5'-end base of the anticodon
7. How many disaccharides consisting of two D-glucose units can be formed?
- (a) Four
  - (b) Eleven
  - (c) Seven
  - (d) Nine
8. Which one of the following conditions will change the equilibrium constant?
- (a) Concentration
  - (b) Temperature
  - (c) Pressure
  - (d) Presence of a catalyst
9. The major second messenger regulating glucagon action is
- (a)  $IP_3$
  - (b) cAMP
  - (c) DAG
  - (d)  $PIP_2$
10. What will happen, if embryos are disaggregated with chemicals or proteases and the individual cells are mixed together in culture?
- (a) The cells will associate with one another randomly
  - (b) The cells will reaggregate to form a normal embryo capable of continuing development
  - (c) The cells will often sort themselves so that like cells are together
  - (d) The cells will regulate to form one or more normal embryos

11. Which one of the following leads to development of active immunity?
- (a) Bacterial infection
  - (b) Natural maternal antibody
  - (c) Antitoxin
  - (d) Humanized monoclonal antibody
12. Which one of the following statements is **not** true for a three-point test cross?
- (a) The heterozygous individual is crossed with a homozygous recessive individual
  - (b) Comparing the double-crossover progeny with the non-recombinant progeny provides information about the middle locus
  - (c) The double-crossover progenies are the most numerous
  - (d) The non-recombinant progenies are the most numerous
13. Plants are said to possess alteration of generation, because
- (a) the haploid stages are multicellular, long-living and retain active metabolic processes
  - (b) they form seeds that live long and can germinate to give the next generation
  - (c) in many plants of lower orders, the gametophytic stage is longer than the sporophytic stage
  - (d) the plants can have both vegetative and sexual reproductions
14. The grasses grazed by cattle rapidly regrow due to their
- (a) apical meristem
  - (b) lateral meristem
  - (c) intercalary meristem
  - (d) axial meristem
15. The crop plant that recently (this year) received attention due to its complete genome sequencing, having significant contribution from several Indian laboratories, is
- (a) chickpea
  - (b) tobacco
  - (c) chilli
  - (d) brinjal

16. Carnivorous plants have adapted to grow where the soil is thin or poor in nutrition, especially
- (a) nitrogen
  - (b) phosphorous
  - (c) calcium
  - (d) magnesium
17. Best example of highly modified apocrine-type sweat glands would be
- (a) sebaceous glands
  - (b) mammary glands
  - (c) eccrine glands
  - (d) outermost epithelial cells of skin
18. Corpus callosum is not seen in the brain of
- (a) kangaroo
  - (b) bat
  - (c) squirrel
  - (d) walrus
19. A meta-population is
- (a) a population in an urban area
  - (b) a network of distinct and non-interacting species
  - (c) a network of distinct but interacting species
  - (d) a population that constantly occupies all suitable habitats in an area
20. According to the heterotroph hypothesis, the first life on earth was able to
- (a) synthesize its food from inorganic compounds
  - (b) feed upon carbohydrates produced by autotrophs
  - (c) feed upon available nutrients in the environment
  - (d) carry on photosynthesis instead of respiration

- 21.** The internal potential energy of a gas is due to the
- (a) molecular configuration of the gas
  - (b) motions of the molecules of the gas
  - (c) number of molecules in the gas
  - (d) temperature of the gas
- 22.** The purpose of choke in tube light is
- (a) to decrease the current
  - (b) to increase the current
  - (c) to decrease the voltage momentarily
  - (d) to increase the voltage momentarily
- 23.** Henry's law states that
- (a) the partial pressure of a gas is proportional to the mole fraction of the gas
  - (b) the partial pressure of a gas is proportional to the temperature of the gas
  - (c) the partial pressure of a gas is proportional to the total pressure of the system
  - (d) the partial pressure of a gas is proportional to the volume occupied by the gas
- 24.** If the M-phase promoting factor is injected into a *Xenopus* primary oocyte, which of the following occurs?
- (a) The oocyte enters  $G_0$  phase
  - (b) The germinal vesicle (nucleus) breaks down
  - (c) The S-phase begins
  - (d) Mitosis is complete
- 25.** Which one of the following lasers utilizes transitions that involve the energy levels of free atoms?
- (a) Gas laser
  - (b) Diode laser
  - (c) Free-electron laser
  - (d) Solid-state laser

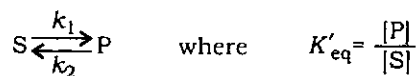
- 26.** Quartz is
- (a) an amorphous solid
  - (b) a pseudo-crystal
  - (c) a liquid crystal
  - (d) a crystalline solid
- 27.** Two steel wires of the same radius have their lengths in the ratio of 1:2, if they are stretched by the same force, then the strains produced in the two wires will be in the ratio of
- (a) 1 : 2
  - (b) 2 : 1
  - (c) 1 : 1
  - (d) 1 : 4
- 28.** Acid-fast stain is used to detect
- (a) *Mycobacterium tuberculosis*
  - (b) *Neisseria gonorrhoeae*
  - (c) *Streptococcus pneumonia*
  - (d) *Filobasidiella neoformans*
- 29.** Which one of the following concentrations of ethyl alcohol acts as the most effective germicide?
- (a) 100%
  - (b) 70%
  - (c) 50%
  - (d) 25%
- 30.** The fermentation of glucose by yeast normally yields
- (a) CO<sub>2</sub>, H<sub>2</sub>O and 36 ATPs
  - (b) alcohol, CO<sub>2</sub> and 2 ATPs
  - (c) alcohol, CO<sub>2</sub> and 36 ATPs
  - (d) lactic acid, CO<sub>2</sub> and 2 ATPs



## PART—B

Answer *any forty* questions

31. Hydrogen bonds and hydrophilic interactions are types of
- (a) weak chemical bonds that hold together the atoms within a molecule
  - (b) strong chemical bonds that hold together the atoms within a molecule
  - (c) weak chemical bonds that link together separate molecules
  - (d) strong chemical bonds that link together separate molecules
32. Which of the following effects would be brought about by any enzyme catalyzing the given reaction?



- (a) Decreased  $K'_{\text{eq}}$ , more negative  $\Delta G'^{\circ}$
  - (b) Increased  $K'_{\text{eq}}$ , increased  $\Delta G'^{\circ}$
  - (c) Decreased  $k_2$ , increased  $\Delta G^{\ddagger}$
  - (d) Increased  $k_1$ , decreased  $\Delta G^{\ddagger}$
33. Approximately how many moles of ATP will be generated as a result of the oxidation of one mole of  $\text{FADH}_2$  in actively respiring mitochondria?
- (a) 0
  - (b) 2.0
  - (c) 3.0
  - (d) 4.0
34. The *E. coli* pyruvic acid dehydrogenase complex is reported to
- (a) decatalyze the oxidation of pyruvic acid to acetyl-CoA and  $\text{CO}_2$
  - (b) catalyze the oxidation of pyruvic acid to acetyl-CoA and  $\text{CO}_2$
  - (c) retard the reduction of pyruvic acid to acetyl-CoA and  $\text{CO}_2$
  - (d) catalyze the reduction of pyruvic acid to acetyl-CoA and  $\text{CO}_2$

- 35.** The catabolism of sugars and fatty acids is similar, because
- (a) both of these compounds generate redox energy during catabolism
  - (b) both of these compounds are funnelled through the TCA/citric acid cycle
  - (c) both of these compounds generate chemical energy during catabolism
  - (d) All of the above
- 36.** Which one of the following amino acids is considered as both ketogenic and glucogenic?
- (a) Valine
  - (b) Tryptophan
  - (c) Lysine
  - (d) Arginine
- 37.** If the activation energy of a reaction at 25 °C is 3.00 kJ/mole and the first-order rate constant for that reaction is 0.500 s<sup>-1</sup> at that temperature, what will be the rate constant for the reaction at 35 °C?
- (a) 5.21
  - (b) 52.1
  - (c) 0.0521
  - (d) 0.521
- 38.** Which one of the following is an example of site-specific recombination?
- (a) Crossing-over during meiosis
  - (b) Gene conversion
  - (c) Integration of bacteriophage  $\lambda$  genome into the *E. coli* chromosome
  - (d) Insertion of a transposon into a new site in a genome
- 39.** In the Meselson-Radding model of meiotic recombination, explain how the two DNA molecules interact at the beginning of homologous recombination
- (a) Single-strand nicks appear at equivalent positions in each molecule
  - (b) A specialized topoisomerase produces single-strand breaks in both DNA molecules
  - (c) The two DNA molecules initiate recombination without breakage
  - (d) A single-strand nick occurs in one molecule creating a free end that invades the other molecule to displace one of its strands

40. The term 'protogenome' describes
- (a) the first DNA genomes
  - (b) the first cellular RNA genomes
  - (c) the early RNA molecules that could self-replicate and direct biochemical reactions
  - (d) the first polymeric RNA molecules
41. Which of the following processes, resulting in gene duplication, occurs when DNA is exchanged between a pair of chromatids within a single chromosome?
- (a) DNA amplification
  - (b) Replication slippage
  - (c) Unequal crossing-over
  - (d) Unequal sister chromatid exchange
42. Cancer of B lymphocytes is called
- (a) sarcoma
  - (b) melanoma
  - (c) myeloma
  - (d) carcinoma
43. The occurrence of pesticides like DDT in higher trophic levels is termed as
- (a) bioremediation
  - (b) biomagnification
  - (c) biological enhancement
  - (d) biopollution
44. Which one of the following DNA repair processes in *E. coli* is the most error-prone?
- (a) Photoreactivation
  - (b) Base excision repair
  - (c) Nucleotide excision repair
  - (d) SOS repair
45. Given that, after fertilization, the  $\text{Ca}^{2+}$  levels go up in embryo which can be monitored and visualized in real time by Fura 2. What kind of  $\text{Ca}^{2+}$  pattern would you expect post-fertilization using Fura 2 during live cell imaging?
- (a) Rapid rise and fall
  - (b) Slow rise and slow fall
  - (c) Slow rise and rapid fall
  - (d) Rapid rise and no fall (constant level)

- 46.** Cytochalasin D prevents actin polymerization and induces actin depolymerization. What will be the effect of cytochalasin D on endocytosis in macrophages?
- (a) Increase
  - (b) Decrease
  - (c) Remain unchanged
  - (d) Cause differentiation
- 47.** Brefeldin A inhibits Golgi to endoplasmic reticulum retrograde transport. If you treat the secretory cells with Brefeldin A, where would the secretory materials be found?
- (a) Endoplasmic reticulum
  - (b) Golgi
  - (c) Lysosomes
  - (d) Cytoplasm
- 48.** A contractile vacuole is an organelle that pumps excess water out of many freshwater protozoan cells. A freshwater protozoan was placed in a solution *A* and observed to form contractile vacuoles at a rate of 11 per minute. The same protozoan was then placed in solution *B* and observed to form contractile vacuoles at a rate of 4 per minute. Based on this information, which of the following statements is correct?
- (a) Solution *A* is hyperosmotic to solution *B*
  - (b) Solutions *A* and *B* are isoosmotic
  - (c) Solution *B* is hyperosmotic to solution *A*
  - (d) Both the solutions are isoosmotic to the protozoan cell
- 49.** Which domain of steroid/nuclear receptors contains transcriptional activation activity?
- (a) NLS region
  - (b) C terminal
  - (c) The domain containing zinc fingers
  - (d) N terminal variable region
- 50.** What happens during the regulation of plasma sodium?
- (a) The granular cells of the afferent arteriole cells secrete renin when plasma sodium is low
  - (b) Angiotensin II is formed from renin by the action of an enzyme found on the endothelium of the pulmonary blood vessels
  - (c) The uptake of sodium ions is regulated by the proximal tubule
  - (d) Sodium transport by the thick ascending limb of the loop of Henle occurs by the same mechanism as that of the proximal tubule

51. Which one of the following is **not** involved in the processing of mRNA precursors in eukaryotic cells?
- (a) Transport of the pre-mRNA to the cytoplasm
  - (b) Capping of the 5' end
  - (c) Splicing of exons
  - (d) Addition of poly A tail
52. Which of the following statements is true with respect to homeobox?
- (a) It is a conserved DNA sequence found in genes that code for proteins that regulate development
  - (b) It is a conserved DNA sequence found in genes that code for proteins that regulate homeostasis
  - (c) It is a conserved DNA sequence found in genes that code for proteins found in glycolytic pathway
  - (d) It is a conserved DNA sequence found in genes that code for proteins involved in segmentation
53. Chromosomal transfer in bacteria occurs during conjugation only if
- (a) the F factor is integrated into the chromosome
  - (b) both cells are donors
  - (c) pili are absent
  - (d) mutations occur simultaneously
54. Assume, you inoculated 100 cells into 100 ml of nutrient broth and 100 cells in 200 ml of nutrient broth. After incubation for 24 hours the cultures have entered stationary phase. You should have
- (a) more cells per ml in the 100 ml
  - (b) more cells per ml in the 200 ml
  - (c) the same number of cells per ml in each
  - (d) None of the above
55. In the presence of low intracellular iron concentrations, the iron response element binding protein (IRE-BP) has which one of the following actions?
- (a) It destabilizes transferrin receptor mRNA
  - (b) It blocks translation of ferritin mRNA
  - (c) It stabilizes ferritin mRNA
  - (d) It allows translation of ferritin mRNA

- 56.** In an experiment, *E. coli* the facultative anaerobe is grown on the same solid medium, but under two different conditions—one aerobic and the other anaerobic. The size of the colonies that grow would be
- (a) same under both conditions
  - (b) larger when grown under aerobic condition
  - (c) larger when grown under anaerobic condition
  - (d) growth does not depend on the conditions
- 57.** Mycorrhizae represents association between plant roots and microorganisms that
- (a) are antagonistic
  - (b) help the plant to take up phosphorus and other nutrient from soil
  - (c) involve algae in association with the plant
  - (d) form nodules on the plant leaves
- 58.** The effectiveness of many antibiotics today is most closely associated with
- (a) bacteriophages
  - (b) F plasmid
  - (c) catabolite repression
  - (d) R plasmid
- 59.** The distance between bacterial genes, as determined from interrupted conjugation experiments, is measured in units of
- (a) recombination
  - (b) minute
  - (c) nucleotide pair
  - (d) micrometer
- 60.** A catalase negative colony growing on a plate that was incubated aerobically, could be from which one of the following genera?
- (a) *Bacillus*
  - (b) *Micrococcus*
  - (c) *Staphylococcus*
  - (d) *Streptococcus*

61. P granules of nematodes are
- (a) determinants of the anterior-posterior axis
  - (b) determinants of germ line
  - (c) precursors of TGF  $\beta$  family signalling proteins
  - (d) remnants of sperm pronucleus
62. The 'organizer' in *Xenopus* is responsible for
- (a) inducing a mesodermal fate in nearby cells
  - (b) initiating involution and gastrulation
  - (c) specifying the dorsal region of the embryo
  - (d) induces the activation of Nieuwkoop centre
63. Engrailed expression defines the
- (a) anterior compartment of the segment
  - (b) anterior margin of each segment
  - (c) posterior compartment of the segment
  - (d) posterior margin of each parasegment
64. Congenic strains of mice
- (a) are genetically identical
  - (b) differ only at a single locus
  - (c) are knocked out at MHC locus
  - (d) do not express  $\beta 2$  microglobulin
65. Expression of MHC genes is
- (a) codominant
  - (b) dominant for maternal alleles
  - (c) dominant for paternal alleles
  - (d) dependent on thymic selection

- 66.** T-cell help for antibody production depends on
- (a) T-cell recognition of native antigen bound to B-cell surface Ig
  - (b) T-cell recognition of antigen processed by the B-cell
  - (c) Class I MHC expression on the B-cell
  - (d) B-cell antibody response in X-irradiated mice
- 67.** The frequency of newborn infants homozygous for a recessive allele is about 1 in 10000. What is the expected frequency of carriers of this allele in the population?
- (a) 0.0180
  - (b) 0.0009
  - (c) 0.0198
  - (d) 0.0019
- 68.** Silky feather in fowls is caused by a recessive mutation. Out of 96 offsprings raised from a cross between two heterozygotes, how many of them are expected to be silky?
- (a) 72
  - (b) 24
  - (c) 32
  - (d) 64
- 69.** Within a population of butterflies with two alleles for colour *B* and *b*, the allele frequency of *B* is 0.7. What would be the frequency of heterozygotes, if the population is in Hardy-Weinberg equilibrium?
- (a) 0.70
  - (b) 0.30
  - (c) 0.21
  - (d) 0.42
- 70.** A non-conditional marker gene product that can be used for the visualization of a given protein in a living cell is
- (a) GFP
  - (b) LacZ
  - (c) HPT
  - (d) NPTII



- 71.** Which one of the following statements is correct about indole acetic acid (IAA) polar transport?
- (a) Cytosolic IAA is largely uncharged and can flow out passively
  - (b) Cytosolic IAA is largely charged and cannot flow out passively
  - (c) Apoplastic IAA is largely uncharged and thus requires carrier proteins
  - (d) Apoplastic IAA is largely charged and enters the cell passively
- 72.** The commonality among auxin, gibberellic acid and jasmonate signalling is that in all the cases hormones
- (a) directly modulate MAP kinase signalling
  - (b) directly activate a transcription factor
  - (c) indirectly activate a transcription factor by removing an inhibitor
  - (d) function independent of transcriptional regulation
- 73.** What could be the most likely effect of vernalization (prolonged cold treatment) on seeds or seedlings that promote flowering on certain plants much later in their life?
- (a) Cold treatment leads to certain hormone secretions that promote flowering
  - (b) Cold treatment induces transcription factors that bring early flowering
  - (c) Cold treatment leads to activation of a G protein coupled receptor signalling that activates flowering
  - (d) Cold treatment leads to epigenetic modification of certain loci that regulates flowering
- 74.** The 'VirE2' gene product of *Agrobacterium tumefaciens* codes for a single-stranded DNA binding protein that wraps the nascent T-DNA. Which one of the following statements is **not** true about the VirE2 protein?
- (a) It protects T-DNA from degradation inside the plant cell
  - (b) It prevents random folding of T-DNA
  - (c) It has nuclear localization signal and helps in transport of T-DNA from cytosol to nucleus
  - (d) It is required for integration of T-DNA in the host genome
- 75.** HIV, a retrovirus, contains
- (a) one single-stranded RNA
  - (b) two copies of positive sense single-stranded RNA
  - (c) two copies of negative sense single-stranded RNA
  - (d) two copies of double-stranded RNA

- 76.** Parvovirus DNA is sensitive to digestion with S1 nuclease. This indicates that genome consists of
- (a) linear DNA
  - (b) single-stranded DNA
  - (c) hairpin DNA
  - (d) double-stranded DNA
- 77.** Gradual and predictable changes in the species composition of a given area is
- (a) primary succession
  - (b) ecological succession
  - (c) xerarch succession
  - (d) secondary succession
- 78.** When two species of different genealogies come to resemble each other as a result of adaptation, the phenomenon is termed as
- (a) microevolution
  - (b) divergent evolution
  - (c) convergent evolution
  - (d) coevolution
- 79.** The theory of evolution by natural selection states that
- (a) selection results in generating variations
  - (b) selection and variations are independent
  - (c) evolution is independent of variation
  - (d) evolution is a rapid process
- 80.** Mouthparts of insects like the cockroach, the mosquito and the butterfly are
- (a) biting, piercing and sucking type, respectively
  - (b) sucking, piercing and biting type, respectively
  - (c) piercing, sucking and biting type, respectively
  - (d) only biting and sucking type

81. Gastrointestinal movement in mammals is under the control of
- (a) sympathetic nervous system and chemicals present in the chime
  - (b) only parasympathetic nervous system
  - (c) both sympathetic and parasympathetic nervous systems as well as chemicals present in the food
  - (d) water contents present in the food
82. Which one of the following statements is **not** correct for muscles?
- (a) Long muscles contract faster than short muscles
  - (b) Weightlifting increases muscle strength by stimulating production of additional muscle fibres
  - (c) Fast muscle fibres differ from slow muscle fibres in the way they respond to nerve impulses and the type of metabolism they rely on
  - (d) Slow muscles do not have nerve supply
83. Nephridia of earthworm are analogous to
- (a) nematoblasts of *Hydra*
  - (b) tracheae of insects
  - (c) flame cells of *Planaria*
  - (d) gills of prawn
84. At the neuromuscular junction
- (a) the muscle membrane possesses muscarinic receptors
  - (b) the motor nerve endings secrete norepinephrine
  - (c) the curare leads to prolongation of neuromuscular transmission
  - (d) the motor nerve endings secrete acetylcholine
85. Which one of the following statements regarding the glomerular filtration rate (GFR) is true?
- (a) The GFR depends on the pressure in the afferent arterioles
  - (b) A substance that has a clearance less than the GFR must have been secreted by the renal tubules
  - (c) The glomerular filtration rate can be determined by measuring the clearance of insulin
  - (d) The glomerular filtrate has the same composition as plasma

86. The velocity of action potential propagation
- (a) is independent of an axon's diameter
  - (b) depends on the thickness of the myelin around the axon
  - (c) will be unaffected if the axon becomes demyelinated
  - (d) is fastest in unmyelinated axons
87. The tertiary structure of tRNA
- (a) is stabilized mostly by Watson-Crick base pairing
  - (b) is stabilized mostly by non-Watson-Crick base pairing
  - (c) does not have Hoogsteen base pairs
  - (d) does not have any base intercalations
88. In circular dichroism (CD) experiments, the mean residual ellipticity value gives a good representation of  $\alpha$ -helix at which wavelength?
- (a) 150 nm
  - (b) 222 nm
  - (c) 280 nm
  - (d) 400 nm
89. A lens forms a sharp image on the screen on inserting a parallel sided slab of glass between the lens and the screen. It is found necessary to move the screen a distance  $d$  away from the lens in order to focus the image sharply. If the refractive index of the glass relative to air is  $\mu$ , then the thickness of the glass slab is given by
- (a)  $\frac{d}{\mu}$
  - (b)  $\mu d$
  - (c)  $\frac{\mu d}{(\mu - 1)}$
  - (d)  $\frac{(\mu - 1)d}{\mu}$
90. Which one of the following types of neurons is primarily lost in Alzheimer's disease?
- (a) Dopaminergic
  - (b) Cholinergic
  - (c) Aminergic
  - (d) GABAergic

91. In a frog gastrocnemius-sciatic (nerve-muscle) preparation, electrical stimulation of the nerve cause twitching of the muscles. Direct stimulation of the muscle also caused twitching of the muscles. If the nerve was continuously stimulated with high frequency pulses for a long time, the muscle twitch gradually reduced and finally stopped. However, under such conditions, if the muscle was stimulated directly, it twitched. These observations suggest that
- (a) electrical stimulation of the nerve directly communicated to the muscle for contraction
  - (b) high-frequency stimulation of the nerve induced fatigue by exhaustion of the neurotransmitter at the synapse
  - (c) there is gap (synaptic cleft) between the nerve and the muscle and acetylcholine is involved in muscle contraction
  - (d) the nerve cannot conduct high-frequency stimulation
92. Which one of the following compounds is an inhibitor of sodium dependent glucose transport across the plasma membrane?
- (a) Ouabain
  - (b) Sodium azide
  - (c) Dicumarol
  - (d) Phlorhizin
93. Which one of the following statements about telomerase is **incorrect**?
- (a) It is an enzyme that adds DNA to telomeres
  - (b) It serves as the template for the lengthening of the telomeres
  - (c) It is not activated in cancer cells
  - (d) Its activity continually resets the cellular clock
94. Which one of the following types of cancer is developed from a loss of tumour suppression?
- (a) Acute T-cell leukemia
  - (b) Wilms' tumour
  - (c) Burkitt's lymphoma
  - (d) Rous sarcoma
95. Which one of the following is a tool for the identification of motifs?
- (a) COPIA
  - (b) BLAST
  - (c) PROSPECT
  - (d) Pattern hunter

96. Shotgun cloning differs from the clone-by-clone method in which of the following ways?
- (a) The location of the clone being sequenced is known relative to other clones within a genomic library in the shotgun cloning
  - (b) Genetic markers are used to identify clones in shotgun cloning
  - (c) No genetic or physical maps of the genome are needed to begin shotgun cloning
  - (d) The entire genome is sequenced in the clone-by-clone method but not in shotgun cloning
97. Ionizing radiation has been shown to up-regulate many genes, depending both on radiation dose and time after irradiation. Because of this, there is an interest in developing gene therapy vectors containing suicide genes with radiation-inducible gene promoters in order to increase the toxicity of radiation locally at the tumour site. Which one of the following genes contains a promoter that could be used for this purpose?
- (a) EGR 1
  - (b) Actin
  - (c) Caspase 8
  - (d) Ku-80
98. An example of radiation induced asymmetric chromosomal aberration is
- (a) an inversion
  - (b) a translocation
  - (c) deletion
  - (d) dicentric chromosome
99. In isoelectric focusing, proteins are separated on the basis of their
- (a) relative content of positively charged residues only
  - (b) relative content of negatively charged residues only
  - (c) size
  - (d) relative content of positively and negatively charged residues
100. Which one of the following types of information cannot be determined from the traditional Northern blotting technique?
- (a) Half-life of an mRNA
  - (b) Amino acid sequence of the protein coded by an mRNA species
  - (c) Strand of DNA that is transcribed into an mRNA
  - (d) Size of an mRNA species

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