Multiple Choice Questions in Microbial Molecular Genetics

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PREFACE

The MCQ exam will focus on the content delivered in the different sessions that you have performed during your course. Material for the MCQ exam can be drawn from a number of sources, but will be based largely on lecture content in the course.

In this book, the multiple choice questions have been prepared with great care such that the questions framed are Precise and clear enabling the reader to make correct choices. A wide coverage of topics in Molecular biology and Genetics is given. The book is primarily meant for students appearing for competitive examinations and to provide the students with a feedback on their progress and an opportunity to improve.

How to answer the MCQ test

- Summative test consists of 202 Multiple Choice Questions to be answered in an effective way to use this test is to allow yourself one minute to answer each question in the book. As you proceed, indicate your answer beside each question
- Enter your name/and Enter your student number
- The single choice answer is recorded

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1) In a DNA molecule, deoxyribonucleotides are joined into a polymer by the covalent linkage of a phosphate group. The covalent link termed as:

a) hydrogen bond
b) glycosylic bond
c) phosphodiester bond
d) covalent linkage

2) The structure of RNA differs from that of DNA, as RNA contains:

a) The sugar ribose instead of deoxyribose
b) uracil instead of thymine
c) it contain Cytosine
d) a and b

3) Two separate chains of DNA are wound around each other, each following a helical (coiling) path, resulting in:

a) single strand coiling
b) a right-handed double helix
c) alpha helix
d) primary structure

4) Replication of a bacterial chromosome normally starts at a fixed point called:

a) replication fork
b) recognition site
c) *oriV*
d) *ter*

5) Which of the following is true for the mechanism of excision repair?

a) Endonuclease cleavage removes a portion of the damaged strand.
b) The gap is filled in by DNA polymerase I
c) Thesugar-phosphate backbone is resealed by DNA ligase.
d) All of the above are correct.

6) The term *cistron*, refers to:

a) region in tRNA molecule
b) codon
c) region of the DNA that codes for a single polypeptide chain
d) ribosomal protein

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7) Bacterial ribosomes typically consist of two subunits, the larger (50 S) subunit consist of:

a) single RNA molecule (16 S) and 21polypeptides.
b) Two RNA molecules (30 S and 50 S) plus 31 different polypeptides.
c) single RNA molecule (18 S) and 21polypeptides
d) Two RNA molecules (23 S and 5 S) plus 31 different polypeptides.

8) Bacterial ribosomes typically consist of two subunits, the smaller one (30 S) contains:

a) single RNA molecule (16 S) and 21 polypeptides.
b) Two RNA molecules (30 S and 50 S) plus 31 different polypeptides.
c) single RNA molecule (18 S) and 21 polypeptides
d) Two RNA molecules (23 S and 5 S) plus 31 different polypeptides.

9) Which of the following is relevant for ribosomal attachment of specific sequence in bacteria?

a) The ribosome-binding site
b) the Shine–Dalgarno sequence
c) This sequence is partly complementary to the 3- end of the 16 S rRNA
d) All above is sufficient.

10) Which of the following is true for using genome southern blotting?

a) to identify the sequences
b) to identify the number of sequences
c) to identify DNA fragments
d) to identify RNA sequence

11) The stringent response is triggered by ----------which leadsto the presence of uncharged tRNA occupying the A site of the ribosome.

a) mRNA
b) hemolysin
c) amino acid starvation
d) water

12) The base composition (GC%) of bacterial DNA varies widely from one species to another ---------- but closely related organisms tend to have similar DNA base compositions

a) over a range of 20–80%
b) over a range of 10–20%
c) 5%
d) 10%

13) the genera *Staphylococcus* and *Micrococcus* aremorphologically similar Gram-positive cocci. However:

a) *Micrococcus* has a high GC content (about 70% GC), whereas *Staphylococcus* DNA has a low proportion of GC content (30–39%).
b) *Staphylococcus* has a high GC content, whereas *Micrococcus* DNA has a low proportion of GC.
c) *Micrococcus* has a high GC content (about30% GC), whereas *Staphylococcus* DNA has a low proportion of G + C (10%).
d) *Staphylococcus* has a high GC content (about 70% GC), whereas *Micrococcus* DNA has a low proportion of GC (about 30%).

14) Bacteriophage T4, is a virulent bacteriophage of *E. coli*, which contains:

a) a linear DNA molecule of about 165 kb.
b) a circular DNAmolecule of about 50 kb.
c) a linear DNAmolecule of about 40 kb.
d) All of the above are false

15) Which of the following is true for Disruption of secondary and tertiary structure of protein by heat or extremes of pH:

a) denaturation of the protein
b) formation of a random coil conformation.
c) formation of tertiary structure
d) a and b correct

16) In nucleic acids, the bases are covalently attached to the 1-position of a pentose sugar ring, to form a:

a) nucleotide
b) DNA single strand
c) nucleoside
d) Glycosidic bond.

17) The bond between the bases and the sugars in DNA referred as:

a) hydrogen bond
b) glycosylic bond
c) phosphodiester bond
d) covalent linkage

18) Which of the following is correct for the A form of DNA structures?

a) a wider than B form.
b) more compressed structure in which the base pairs aretilted with respect to the helix axis, and actually lie off the axis.
c) The helical repeat of the A-form isaround 11 bp/turn
d) All of the above are correct.

19) In strong acid and at elevated temperatures, for example perchloric acid ($HClO_4$) at more than 100°C, nucleic acids tends to:

a) break of some hydrogen bonds
b) hydrolyzed completely to their constituents
c) denaturation of some nucleotides
d) denaturation of some nitrogen bases

20) The effect of alkali is to change the ----------of the DNA structure:

a) deoxy ribose sugar
b) phosphodiester bonds
c) tautomeric state
d) GC content

21) The *A*260/*A*280 ratio of a double-stranded DNA sample can be used to assess its purity. The value for the pure DNA is ----------

a) 3
b) 1.8
c) above 2
d) below 1.5

22) The renaturation of regions of complementarity between different nucleic acid strands is known as-------

a) thermal denaturation
b) DNA repair
c) melting temperature
d) hybridization.

23) If the twisting of the DNA is in the same direction as that of the double helix, that is the helix is twisted up before closure, This form of super coiling is known as;

a) negatively supercoiled
b) positively supercoiled
c) L form supercoiled
d) Z form supercoiled

24) Enzymes that regulate the process of supercoiling termed as;

a) DNA helicases
b) topoisomerases
c) nucleases
d) DNA polymerases

25) DNA gyrase and topoisomerase IV are the targets of anti-bacterial drugs. Whereas type I and II are target of:

a) anti-tumor agents in humans.
b) anti fungus agents
c) anti-bacterial drugs in bacteria
d) All of the above are correct.

26) The *E. coli* chromosome is a closed-circular DNA of length 4.6 million base pairs, which resides in a region of the cell called the:

a) nucleosome
b) nucleotide
c) nucleoid
d) DNA domains

27) The DNA domains are compacted by wrapping around nonspecific DNAbindingproteins such as:

a) histone-like proteins
b) HU
c) H-NS
d) All of the above are correct.

28) The nucleosome core is the basic unit of chromosome structure, consisting of aprotein octamer containing two each of the core histones, with:

a) 146 kbp of DNA
b) 14 bp of DNA
c) 146 bp of DNA
d) 146 bp of RNA

29) A nucleosome core plus H1 is known as a:

a) nucleosome
b) chromatosome
c) chromatin
d) nucleoid

30) The linker DNA between the nucleosome cores varies between:

a) less than 10 and more than 100 bp
b) less than 100 and more than 1000 bp
c) less than 1000 and more than 1500 bp
d) less than 1 and more than 10 bp

31) More than 50% of the mass of chromatin is:

a) DNA
b) protein.
c) RNA
d) fiber

32) Chromosomes greatly alter their level of compactness as cells progress through the cell cycle, varying between highly condensed chromosomes at:

a) metaphase (just before cell division)
b) interphase
c) nuclear matrix
d) chromosomal loops

33) The ends of the linear chromosomal DNA are protected from degradation and gradual shortening by the:

a) endonucleases
b) exonucleases
c) telomeres
d) cap structure

34) ----------is the more diffuse region of the interphase chromosome, consisting of inactive regions in the 30 nm fiber form.

a) Heterochromatin
b) chromatosome
c) nucleosome
d) Euchromatin

35) 5-CG-3_(CpG) sequences in mammalian DNA are normally methylated on the:

a) guanine base
b) cytosine base
c) thymine base
d) All of the above are false.

36) Which of the following is true for Satellite DNA?

a) Occurs mostly near the centromeres of chromosomes
b) may be involved in attachment of the mitotic spindle
c) consists of hugenumbers of tandem repeats of short (up to 30 bp) sequences.
d) All of the above are correct.

37) The coding regions of genes are interrupted by ------ sequences.

a) intron
b) exon
c) chromosomal loops
d) stop codon

38) When the same region, or locus, of a chromosome has two (or more) slightly different DNA sequences in different chromosomes or individuals of the same species, these are described as:

a) Satellite DNA
b) Dispersed repetitive DNA
c) polymorphs
d) moderately repetitive DNA

39) SNPs can occur within the short sequences that are recognized by restriction enzymes and thus the length of a fragment generated by cutting a DNA molecule with a restriction enzyme could be different for each allele.This is known as a:

a) polymerase chain reaction (PCR)
b) restriction fragment length polymorphism (RFLP)
c) real time PCR
d) variable number tandem repeats (VNTRs)

40) In the retroviruses, the single-stranded RNA molecule is converted to a double-strandedDNA copy (Ts replace Us), which is then inserted into the genome of the hostcell. This process has been termed:

a) transcription
b) translation
c) reverse transcription
d) central dogma

41) For pure DNA, the value is 1.8. The value below 1.8 suggests ------

a) protein contamination
b) RNA contamination
c) Lipid contamination
d) Primer dimer

42) The thermal denaturation of DNA may be reversed by cooling the solution. Rapid cooling allows:

a) the formation of local regions of dsDNA, formed by the base pairing of short regions of complementarity within or between DNA strands
b) the wholly complementary DNA strands to find each other.
c) Completely double helix formation
d) All of the above are correct.

43) ---------- a bacterial enzyme, uses the energy of ATP hydrolysis to introduce negative supercoiling into DNA hence removing positive supercoiling generated during replication.

a) nucleases
b) DNA polymerases
c) helicases
d) DNA gyrase

44) The major protein components of chromatin referred as:

a) histones
b) histones like proteins
c) RNA polymerases proteins
d) Transcriptional factors proteins

45) In some organisms, examples are known where the sequence of the messenger RNA is altered after it is transcribed from the DNA, in a process known as:

a) RNA editing
b) RNA splicing
c) methylation
d) phosphorylation

46) In prokaryotes, the enzyme ----------transcribes a gene from the promoter.

a) DNA polymerase
b) primase
c) RNA polymerase
d) DNA ligase

47) The codingregions of the messenger RNA are translated into proteins by:

a) RNA polymerase
b) ribosomes
c) reverse transcriptase
d) polycistronic

48) In eukaryotes:

a) transcription takes place in the nucleus
b) translation expressionin the cytoplasm
c) the messenger RNAs are consequently longer-lived.
d) All of the above are correct

49) In eukaryotes, the RNAs are modified in the nucleus by:

a) capping at the 5′-end
b) the addition of a poly(A) tail at the 3′-end
c) the addition of cap structure at the 3′-end
d) a and b are correct

50) The introns in the pre-mRNA must be removed to produce continuous protein coding sequence in a process known as:

a) methylation
b) splicing
c) capping
d) post translation events

51) The point at which separation of the strands and synthesis of new DNA takes place is known as the:

a) Ori C
b) replication fork
c) Ori V
d) replication bubbles

52) Any piece of DNA which replicates as a single unit is called

a) replicon
b) new complementary daughter strand
c) single strand DNA
d) All of the above are false

53) One DNA strand, the----------, is made continuously in a 5→3 direction from the origin.

a) laggingstrand
b) template strand
c) parental strand
d) leading strand

54) In replication: soon after synthesis, the DNA fragments are joined to make one continuous piece of DNA by the enzyme:

a) DNA ligase
b) DNA polymerase
c) primase
d) helicase

55) The single-stranded bubble created in DNAreplication is coated with ----------to protect it from breakage and to prevent theDNA renaturing.

a) DNA helicase
b) DNA polymerase
c) single stranded binding protein
d) primase

56) Both leading and lagging strand primers are elongated by:

a) RNA polymerase
b) DNA polymerase III holoenzyme
c) DNA gyrase
d) topoisomerase

57) In the cell cycle: there are four main phases, G1, S, G2 and M phase. S phase is the :

a) DNA synthesis phase
b) cell division phase
c) protein synthesis phase
d) transcription phase

58) Cells can enter a nonproliferative phase fromG1, which is called :

a) G0 phase
b) quiescence
c) L form cells
d) a and b are correct

59) **The introns in the pre-mRNA must be removed to produce the exons by RNA-protein complexes known as:**

a) snRNPs
b) endonucleases
c) RNA polymerase II
d) RNA polymerase I

60) The initiation of DNA replication within a replicon always occurs at a fixed pointknown as:

a) the replication fork
b) the point of origin
c) the replication bubbles
d) the terminus

61) The initiation of a cell division cycle requires the presence of:

a) extracellular growth factors
b) mitogens
c) primer
d) a and b are correct

62) In eukaryotes, clusters (tandem arrays) of about 20–50 replicons initiate simultaneously at defined times throughout:

a) G1 phase
b) S phase
c) G2 phase
d) M phase

63) In ----------mutation onepurine (or pyrimidine) is replaced by the other.

a) transversion
b) transition
c) frameshift
d) All of the above are false

64) Which of the following is true for the most important form of DNA damage which produces pyrimidine dimers from adjacent pyrimidine bases?

a) X ray
b) UV light
c) 5 bromo uracil
d) Acridine orange

65) ----------is spontaneous hydrolytic reaction that involvescleavage of the *N*-glycosylic bond between *N*-9 of the purine bases A and Gand *C*-1_ of the deoxyribose sugar and hence loss of purine bases from theDNA.

a) deamination
b) oxidation
c) depurination
d) thymine dimer

66) Alkylating agents are electrophilic chemicals which readily add alkyl groups to various positions on nucleic acids. A common example is:

a) methylmethane sulfonate
b) 8-oxoguanine
c) 2-oxoadenine
d) 5-formyluracil

67) Cyclobutane pyrimidine dimers are formed by ----------from adjacentpyrimidines on one strand by cyclization of the double-bonded C5 and C6carbon atoms of each base to give a cyclobutane ring.

a) UV light
b) X ray
c) 5 bromo uracil
d) Acridine orange

68) Cleavage of the cyclobutane ring of pyrimidine dimers by ----------restores the original DNA structure.

a) endonuclease
b) exonuclease
c) DNA photolyases
d) DNA glycosylase

69) The mismatched base is removed from the daughter strand of DNA by :

a) DNA photolyases
b) Alkyltransferase
c) exonuclease
d) excision repair mechanism.

70) In nucleotide excision repair, an endonuclease makes nicks on either side of the lesion.

a) endonuclease
b) exonuclease
c) DNA photolyases
d) DNA glycosylase

71) Mutations in excision repair genes or a translesion DNA polymerase cause:

a) xeroderma pigmentosum
b) a sun-sensitive cancer-prone disorder
c) defective in Cockayne syndrome
d) All of the above are correct

72) in *E. coli*, the UvrABC endonuclease removes ----------andother bulky lesions by recognizing the distortion these produce in the doublehelix.

a) pyrimidine dimmers
b) alkyl group
c) methyl group
d) one nitrogen base

73) Ineukaryotes, gap filling in BER involves predominantly DNA polymerase βwhereas the longer gaps generated in NER are filled by:

a) DNA ligase
b) DNA polymerases δ or ε.
c) DNA polymerase I
d) DNA polymerase II

74) The exchange of homologous regions between two DNA molecules occursextensively in eukaryotes during:

a) meiosis
b) mitosis
c) a and b are correct
d) a and b are false

75) Which of the following is true for exchange of homologous regions between two DNA molecules:

a) general recombination
b) homologous recombination
c) Site-specific recombination
d) a and b are correct

76) ----------are sets of DNA clones, each of which has been derived from theinsertion of a different fragment into a vector followed by propagation in thehost.

a) Gene cloning
b) DNA libraries
c) Genetic engineering
d) gene therapy

77) ----------Digests single-stranded nucleic acids, but will leave intact any region which isdouble helical

a) RNA polymerase
b) DNA polymerase
c) Mung bean nuclease
d) Reverse transcriptase

78) When an electric field is applied to an agarose gel in the presence of a buffersolution which will conduct electricity, DNA fragments move through the geltowards the:

a) Negative electrode
b) Positive electrode
c) positive and negative electrode
d) All of the above are correct

79) The use of a restriction enzyme, followed by DNA ligase, can create----------, with a target DNA fragment inserted into a vectorplasmid.

a) blunt end
b) cohesive end
c) recombinant DNA molecule
d) clones

80) Treatment of the linear vector molecule with alkaline phosphatase will:

a) remove the 5_-phosphates
b) render the vector unable to ligate into a circle without an inserted target
c) reducing the proportion of recreated vector in the mixture.
d) All of the above are correct

81) The efficiency of the transformation step is given by the:

a) number of antibiotic-resistant colonies per microgram of input plasmid DNA.
b) number of antibiotic-resistant colonies per gram of input plasmid DNA.
c) number of cloning vectors molecule per microgram of input plasmid DNA.
d) a and b are correct

82) Recombinant plasmids can be distinguished from vectors by:

a) size on an agarose gel and by excising the inserted fragment with the same restriction enzyme(s) used to insert it.
b) using RFLP technique
c) transformation
d) All of the above are correct

83) the *E. coli* ligases uses NAD+, and the ligase enzyme from bacteriophage T4 uses:

a) Cacl2
b) ATP
c) Mn2+
d) NAD+

84) Insertional inactivation of the *lacZ*$^-$ gene on a plasmid can be used to screenfor recombinants on a plate containing:

a) Tetracycline and ampicillin
b) Tetracycline only
c) IPTG and X-gal.
d) IPTG only

85) The pUCvector, contain anengineered version of the *lacZ*$^-$ gene, which has multiple restriction enzymesites within the first part of the coding region of the gene. Thisregion is known as the:

a) blunt end
b) cohesive end
c) multiple cloning site
d) origin of replication

86) The infection and subsequent lysis of *E. coli* by bacteriophage may be usedto propagate cloned DNA fragments. Nonessential portions of the phage lineargenome may be replaced by:

a) 48.5 kb of foreign DNA
b) up to 23 kb of foreign DNA.
c) up to 10 kb of foreign DNA.
d) 50 kb of foreign DNA

87) A number of so-called replacement vectors have been developed from phageλ ; examples include:

a) PBR322
b) EMBL3
c) **λ** DASH
d) b and c

88) Cosmids have a capacity for clonedDNA of:

a) 30–45 kb
b) 10 kb
c) more than 50 kb
d) 20 kb

89) Which of the following is true for yeast artificial chromosomes?

a) may be more than 1 Mb in length.
b) contain two telomeric sequences (TEL), one centromere (CEN), one autonomously replicating sequence (ARS)
c) contain genes which can act as selectable markers in yeast.
d) All the above are correct

90) The bacterium----------, which infects some plants and integrates part ofits Ti plasmid into the plant genome, has been used to transfer foreign genesinto a number of plant species.

a) *Rhizobium alamii*
b) *Agrobacterium tumefaciens*
c) *Aminobacteranthyliides*
d) *Bradyrhizobiumarachides*

91) The part of the Ti plasmid, ----------, is integrated into the plantchromosomal DNA.

a) T-DNA
b) opines
c) ori T
d) Leu 2

92) Yeast vectors (YEps) have been developed using :

a) The replication origin of the natural yeast 2 micron plasmid,
b) have selectable markers such as *LEU2*.
c) They can replicate as transposon
d) a and b are correct

93) Which of the following is true for bacterial artificial chromosomes are?

a) based on the F factor of *E. coli*
b) can be used to clone up to 350 kb of genomic DNA in a conveniently-handled *E. coli* host.
c) They are a more stable and easier to use alternative to YACs.
d) All the above are correct

94) ----------vectors can beused to construct genomic libraries.

a) Plasmids
b) **λ** phage
c) cosmid
d) yeast artificial chromosome
e) All the above are correct

95) To avoid blunt end ligation of cDNA to vector, ----------are usually added tothe cDNA after the ends have been repaired (blunted) using a single strandspecificnuclease followed by Klenow enzyme.

a) Alkaline phosphatase
b) linkers
c) plasmid
d) Oligo(dT)

96) The ----------is used to amplify a sequence of DNAusing a pair of oligonucleotide primers each complementary to one end of theDNA target sequence.

a) GenBank
b) automated DNA sequencing
c) polymerase chain reaction (PCR)
d) Bioinformatics

97) The enzyme ----------can remove one strand of nucleotides in a 3⁻ to 5⁻direction from a recessed 3⁻-end, but not from a 3⁻-protruding end.

a) exonuclease III
b) endonucleae
c) *EcoR1*
d) *Hind111*

98) In both prokaryotes and eukaryotes, primary RNA transcripts undergovarious alterations or processing events to become mature RNAs. The commonest types are:

a) nucleotide removal by nucleases
b) nucleotide addition to the 5- or 3-end
c) nucleotide modification on the base or the sugar.
d) All of the above are correct

99) An initial 30S transcript is made in *E. coli* by ----------transcribingone of the seven rRNA operons.

a) DNA polymerase
b) RNA polymerase
c) a and b
d) nuclease

100) In the nucleolus of eukaryotes, ----------enzyme transcribes therRNA genes.

a) RNA polymerase I
b) RNA polymerase II
c) RNA polymerase III
d) All of the above are correct

101) The *E. coli* 70S ribosome is formed from a large 50S and a small 30S subunit. The large subunit contains 31 different proteins and:

a) a 16S rRNA molecule and 21 different proteins.
b) one each of the 23S and5S rRNAs
c) a 16S rRNA molecule and 55 different proteins
d) one each of the 5S and 18S rRNAs

102) The concept of the operon was first proposed in 1961 by:

a) Jacob and Monod
b) George Beadle
c) Frederick Sanger.
d) Herbert Boyer

103) The lactose operon consistsof three structural genes: *lacZ*, which codes for Beta-galactosidase, *lacY*, whichencodes a:

a) thiogalactoside transacetylase.
b) galactoside permease
c) translocase
d) All of the above are false

104) The various applications of gene cloning include:

a) recombinant protein production
b) genetically modified organisms
c) DNA fingerprinting
d) diagnostic kits
e) All of the above are correct

105) The −10 sequence is a 6 bp region present in almost all promoters. Thishexamer is generally 10 bp upstream from the start site. The consensus –10sequence is:

a) TAATAT
b) TATAAT
c) TTGACA
d) TATGAC

106) The σ^{70}promoter consists of a sequence of between:

a) 40 and 60 bp.
b) 80 and 90 bp
c) 100 and 160 bp
d) 10 and 20 bp

107) The Pribnow box hexamer is separated by---------- from the transcription start site.

a) between 5 and 8 bp
b) between 10 and 20 bp
c) between 20 and 30 bp
d) All of the above are false

108) The transcription start site is a --------in 90% of all genes.

a) purine
b) uracil
c) a and b are correct
d) a and b are false

109) The RNA polymerase moves along the DNA maintaining a constant region ofunwound DNA called the:

a) Pribnow box
b) transcription bubble
c) Hogness box
d) consensus sequence

110) When σfactor is added to the core RNA polymerase enzyme to form the ----------, it markedly reducesthe affinity for nonspecific sites on DNA by 20 000-fold.

a) closed complex
b) open complex
c) tight binding
d) holoenzyme

111) The −35 sequence is a further 6 bp region recognizable in most promoters.This hexamer is typically 35 bp upstream from the start site. The consensus–35 sequence is:

a) TAATAT
b) TATAAT
c) TTGACA
d) TATGAC

112) The most conserved sequence inσ^{70}promoters is a ---------- which is foundin the promoters of many different *E. coli* genes.

a) 30 bp sequence
b) 20 bp sequence
c) 6 bp sequence
d) 12 bp sequence

113) The initialunwinding of the DNA (in transcription process) results in formation of an open complex with the polymerase;and this process is referred to as:

a) holoenzyme
b) tight binding
c) closed complex
d) core enzyme

114) The RNA polymerase remains bound to the DNA and continues transcriptionuntil it reaches a ----------at the end of the transcription unit.

a) promoter sequence
b) stop signal
c) terminator sequence
d) b and c are correct

115) The RNA hairpin is oftenfollowed by a sequence of four or more -------residues

a) A
b) U
c) C
d) G

116) The *trp*operon encodes ----------structural genes involved in tryptophanbiosynthesis.

a) three
b) five
c) six
d) four

117) Tryptophan, the end-product ofthe enzymes encoded by the *trp*operon, therefore acts as a co-repressor andinhibits its own synthesis through:

a) CRP protein
b) *trp*promoter sequence
c) end-product inhibition.
d) All of the above are correct

118) The most common stop signal (in transcription process) is ----------inwhich the RNA transcript is self-complementary

a) RNA hairpin
b) transcription bubble
c) tight binding
d) open complex

119) The ----------is responsible for recognition of consensus promotersequences and is only required for transcription initiation.

a) attenuator
b) σ factor
c) β subunit
d) α subunit

120) The ---------subunit is the most common σ factor in *E. coli* which is responsible for recognition of general promoters which haveconsensus –35 and –10 elements.

a) σ^{35}
b) σ^{50}
c) σ^{28}
d) σ^{70}

121) RNA polymerase I is:

a) located in the nucleoli
b) responsible for the synthesis of the precursors of most rRNAs
c) responsible for thesynthesis of mRNA precursors and some small nuclear RNAs.
d) a and b are correct

122) In eukaryotes ,the pre-rRNA transcription units contain three sequences that encode the:

a) 16S, 5.8S and 28S rRNAs
b) 18S, 5.8S and 28S rRNAs
c) 18S, 5.8S and 18S rRNAs
d) All of the above are false

123) Pre-rRNA is synthesized by---------- in the nucleolus.

a) RNA polymerase I
b) RNA polymerase II
c) RNA polymerase III
d) Primase

124) Selectivity factor 1 (SL1) is made up of four subunits. These include the TATA-binding protein(TBP) which is required for transcription initiation by all three RNApolymerases. The other factors are RNA Pol I-specific TBP-associated factorscalled:

a) TAF_Is
b) TTGACA
c) RTBP
d) SL1 – TBP

125) Some eukaryotic genes contain an ----------instead of a TATA box , located around the transcription start site.

a) Enhancer
b) SP1 box
c) initiator element
d) CCAAT box

126) RNA polymerase II is:

a) located in the nucleoplasm
b) located in the nucleoli
c) is responsible for the synthesis of mRNA precursors and some small nuclear RNAs.
d) a and c are correct

127) Which of the following is true for RNA polymerase III?

a) located in the nucleoli
b) responsible for the synthesis of the precursors of 5S rRNA, tRNAs and other small nuclear and cytosolic RNAs.
c) responsible for the synthesis of mRNA precursors and some small nuclear RNAs.
d) responsible for the synthesis of the precursors of most rRNAs

128) The enhancers have the following general characteristics:

a) they exert strong activation of transcription of a linked gene from the correctstart site.
b) They activate transcription when placed in either orientation with respect tolinked genes.
c) They are able to function over long distances of more than 1 kb whetherfrom an upstream or downstream position relative to the start site.
d) All the above are correct

129) Ribosomes are complexes of ----------molecules and specific ribosomal proteins.

a) tRNA
b) rRNA
c) mRNA
d) RNA Polymerase III

130) In the prokaryote, *E. coli*, there are seven different operons for rRNA that aredispersed throughout the genome. Eachoperon contains one copy of each of the:

a) 16S, 5.8S and 28S rRNA sequences
b) 16S,5S and 23S rRNA sequences
c) 18S, 5.8S and 18S rRNAsequences
d) 18S, 5.8S and 28S rRNAsequences

131) RNase P is an ----------composed of one RNA molecule and one proteinmolecule.

a) exonuclease
b) endonuclease
c) primase
d) telomerase

132) The Watson and Crick structure of DNA refers to:

a) The B form
b) a right-handed helix with 10 base-pairs per turn
c) The bases in the centre, held together by hydrophobic interactions and phosphate bonding.
d) a and b

133) Both miRNAs and one strand of siRNAs are bound byproteins to form a ribonucleoprotein complex called:

a) RISC (RNA-induced silencing complex)
b) dsRNA
c) small nuclear RNP
d) carboxy-terminal domain (CTD)

134) ----------is the processwhereby sense, antisense, or dsRNA can cause inhibition of expression of anhomologous gene.

a) RNA interference
b) RNA splicing
c) homopolymer tailing
d) methylation

135) In eukaryotes, mRNA issynthesized by RNA Pol II as longer precursors (pre-mRNA), the populationof different pre-mRNAs being called:

a) heterogeneous nuclear RNA (hnRNA).
b) micro RNAs (miRNAs)
c) short interfering RNAs (siRNAs).
d) ribosomal RNA (rRNA)

136) ---------- is the addition of a 7-methylguanosine nucleotide (m7G) to the 5-end ofan RNA Pol II transcript when it is about 25 nt long.

a) 3′-cleavage,
b) 5′-capping,
c) polyadenylation
d) methylation

137) ----------processing is the conversion of pre-mRNA species intomore than one type of mature mRNA. This can result from the use of differentpoly(A) sites or different patterns of splicing.

a) methylation
b) phosphorylation
c) Alternative mRNA
d) RNA editing

138) From a fixed start point, each groupof three bases in the coding region of the mRNA represents a:

a) codon
b) nucleotide
c) gene
d) polynucleotide

139) When 18 out of 20 amino acids have more than one codon to specify them, and these codon referred as:

a) universal codons
b) synonymous codons
c) overlapping codons
d) a and b are correct

140) The linear sequence (primary structure) of tRNAs is:

a) 60–95 nt long
b) 30–40nt long
c) 10–30nt long
d) 120-150nt long

141) There are many modified nucleosides present in tRNA structure, such as :

a) pseudouridine
b) inosine
c) adenosine
d) a and b are correct

142) The----------is a common secondary structural representation oftRNA molecules which shows the base pairing of various regions to form fourstems (arms) and three loops.

a) L shape
b) Tertiary structure
c) Cloverleaf structure
d) The Dloop

143) tRNA molecules become charged or aminoacylated in a two-step reaction, in the first step, the----------enzyme attaches AMP to the -COOH group of the amino acid.

a) terminal transferase
b) aminoacyl-tRNA synthetase
c) alkaline phosphatase
d) transformylase

144) The ----------, recognizing the AUG start codon, is used toinitiate protein synthesis in both prokaryotes and eukaryotes.

a) polysome
b) ribosome binding site
c) mRNA
d) Initiator tRNA

145) The initiation factors (IF1 and IF3) bind to ----------, this helps to prevent a large subunitbinding to small subunit without an mRNA molecule and forming an inactive ribosome.

a) tRNA
b) mRNA
c) a free 30S subunit
d) 50S subunit

146) In the initiation step of translation: The 30S subunit attaches to an mRNA molecule making use of the ribosomebindingsite (RBS) on the:

a) ribosome
b) mRNA
c) tRNA
d) 50S subunit

147) IF2 complexed with GTP then binds to the small subunit of ribosome. It will assist:

a) the prevent a large subunitbinding to it without an mRNA molecule
b) the forming an inactive ribosome
c) the charged initiator tRNA to bind
d) a and b are correct

148) The 50S subunit can bind to 30S, The complex formed at the end of the initiation phase is termed as called:

a) The 70S initiation complex
b) The 30S initiation complex
c) The 80S initiation complex
d) The 60S initiation complex

149) Release factor 1 (RF1) recognizes the codons UAA and UAG, and the release factor 2 recognizes the codon:

a) UAG
b) UAA
c) UGA
d) b and c are correct

150) There are mechanisms that deal with the problems of mutant or truncated mRNAs being translated into defective proteins. In the case of truncated mRNAs in prokaryotes, a special RNA called---------- is translated into defective peteins?

a) short interfering RNAs (siRNAs).
b) transfer-messenger RNA(tmRNA)
c) heterogeneous nuclear RNA (hnRNA).
b) micro RNAs (miRNAs)

151) Eukaryotes use ----------which requires GTP, fortermination of protein synthesis.

a) Three release factors (eRF)
b) Tow release factors (eRF)
c) Only one release factor (eRF)
d) All the above are false

152) In Eukaryotes, initiation factors which binds to the mRNA to recognize the 5-cap and to melt secondary structure such as:

a) eIF4B
b) eIF4F
c) eEF2
d) eIF4B and eIF4F

153) In prokaryotes, the level of translation of different cistrons can be affected by:

a) The binding of short antisense molecules
b) The relative stability tonucleases of parts of the polycistronic mRNA
c) the binding of proteinsthat prevent ribosome access
d) All the above are correct

154) Bacteriophage and viral transcripts and many mRNAs for hormones in eukaryotes are translated to give asingle polypeptide chain that is cleaved subsequently by specific proteases toproduce multiple mature proteins from one translation product. The parentpolypeptide is called a:

a) single polypeptide
b) polyprotein
c) Protein secretion
d) signal recognition particle

155) Bacteriophage M13 has a ----------genome, replicates via adouble-stranded DNA replicative form.

a) small double-stranded DNA
b) single-stranded RNA
c) small double-stranded RNA
d) small single-stranded DNA

156) ----------are genes whose overactivity causes cells to become cancerous.

a) Tumor suppressor genes
b) Oncogenes
c) silent genes
d) structural genes

157) ----------involves the sequencing of the complete genome, includingstructural genes, regulatory sequences, and noncoding DNA segments.

a) Transcriptomics
b) Proteomics
c) Genomics
d) Metabolomics

158) The ----------plasmid contains genes coding for the degradation of Toluene.

a) Ti
b) Ri
c) Tol
d) ColE1

159) PlasmidpBR322 was constructed by Bolivar and Rodriguez fromthe ----------and is derivative number 322 of theplasmids they constructed.

a) ColE1 plasmid
b) R – plasmid
c) Ti – plasmid
d) Tol – plasmid

160) In an ----------plasmid, replication occurs in two stages.In the first stage, the double-stranded circular plasmid DNA replicates to form another double-stranded circularDNA and a single-stranded circular DNA, In the second stage, the complementary strand is synthesizedon the single-stranded DNA to make anotherdouble-stranded DNA.

a) all
b) some
c) rolling-circle
d) most

161) In most plasmids, the genes for proteins required forreplication are located very close to the --------at which their gene are transcribed.

a) *ori*sequences
b) single-strand origin
c) double strand origin
d) Rep protein

162) Not all bacteria have circular chromosomes and plasmids.
Some, including ----------have linear chromosomes and often multiple linear plasmids

a) *Borrelia burgdorferi*
b) *Streptomyces* spp.
c) *A. tumefaciens*
d) All the above are correct

163) low-copy-number plasmids, such as F, must replicate only once or very fewtimes during each cell cycle and so must have a tightermechanism for regulating their replication. Hence, theyare called:

a) relaxed plasmids
b) ColE1 plasmid
c) broad host range plasmids
d) stringent plasmids

164) If two plasmids cannot coexist stably, they are said to be members of the:

a) same incompatibility group
b) different incompatibility groups
c) same compatibility group
d) different compatibility groups

165) Most plasmids require aplasmid-encoded protein to initiatereplication, often called ----------required to separate thestrands of DNA at the *oriV*region, often with the help ofhost proteins, including DnaA.

a) Rep protein
b) Iteron
c) DnaA protein
d) All of the above are false

166) The best-known examples of host-encoded sitespecific recombination systems used to resolve plasmiddimers are the *cer*-XerCDsitespecificrecombination systems used by the

a) ColE1 plasmid
b) F plasmid
c) Ti plasmid
d) R plasmid

167) Cells that have lost a plasmid during cell division are said to be ----------of the plasmid.

a) maintenance
b) cured
c) methylated
d) partitioning

168) A very effective mechanism that plasmids have to avoid being lost from dividing cells is ----------systems.

a) maintenance
b) cured
c) methylated
d) partitioning

169) The partitioning system of theR1 plasmid consists of two protein-coding genes, ----------, as well as a centromere-like *cis*-acting site,*parC*.

a) *parS* and *parR*
b) *parD* and *parS*
c) *parM* and *parR*
d) *parC* and *parO*

170) In the F plasmid, the correspondingproteins are called SopA and SopB(*sop*, for stability of plasmid), and the site is called----------

a) *sopC*
b) *sopS*
c) *parC*
d) *parR*

171) The term 'western' blotting refersto a procedure which involves the transfer of ----------from a polyacrylamide gel on to amembrane of nitrocellulose or nylon.

a) DNA bands
b) RNA bands
c) electrophoresed protein bands
d) mRNA bands

172) ----------short fragment of DNA produced during replication ofthe lagging strand.

a) primer
b) promoter
c) Okazaki fragment
d) terminator

173) ----------transfer of RNA molecules from an agarose or acrylamidegel to a filter for hybridization.

a) Northern blot
b) western blot
c) Southern blot
d) All of the above are false

174) ----------A nucleic acid sequence with a reading framethat contains no stop codons; it can therefore potentially be translated intoa polypeptide.

a) promoter
b) Open reading frame
c) terminator
d) regulatory gene

175) A short region of a vector containing a number of unique restriction sites into which DNA can be introduced is termed as:

a) Multiple cloning site
b) Open reading frame
c) origin of replication
d) linker

176) ----------RNA that is complementary to the mRNA, which caninterfere with gene expression by affecting transcription, RNA stability ortranslation.

a) tRNA
b) sense RNA
c) microRNA
d) Antisense RNA

177) ----------RNA domain that binds a ligand, causing a change in secondarystructure of the RNA, thus affecting gene expression.

a) tRNA
b) Aptamer
c) microRNA
d) Antisense RNA

178) A mutant that requires the addition of one or more special growth condition to its growth medium is:

a) Autotroph
b) Auxotroph
c) prototroph
d) Back mutation

179) ----------a protein that affects the folding of other proteins or theassembly of complex structures.

a) Histon H2A
b) Histon like protein
c) Chaperone
d) All of the above are false

180) The region of DNA that codes for a single polypeptide. No longer incommon use except for emphasis (as in polycistronic mRNA) is called a:

a) cDNA
b) Cistron
c) Exon
d) Intron

181) ---------- refers change to the DNA that affects expression of a gene but is not inherited.

a) silent mutation
b) Anti sense mutation
c) Frameshift mutation
d) Epigenetic

182) ---------- Is a specific RNase which cuts RNA–DNA hybrids; involved inreplication of ColE1-like plasmids.

a) RNaseH
b) RNA-directed DNA polymerase
c) RNA polymerase
d) TrpR

183) ---------- Is a sensor in the cell envelope detects environmental changes, and responds by phosphorylating a cytoplasmic protein (the response regulator); this activates or inhibits its regulatory function.

a) Transcriptional factor
b) histidine protein kinase
c) Two-component regulation
d) All the above are correct

184) In *Salmonella* the pleiotropic ----------systemregulates virulence and acid tolerance but actually senses extracellular Mg2+concentrations through the periplasmic input domain of the HPK, PhoQ,which contains several Mg2+-binding acidic amino acids.

a) PhoP-PhoQ
b) EnvZ -OmpR
c) NarX - NarL
d) TodS–TodT

185) A protein known as the ----------is involved in the conversion of GTP totwo unusual nucleotides, ppGpp (guanosine-5_-diphosphate-3_-diphosphate)and pppGpp (guanosine-5_-triphosphate-3_-diphosphate). These nucleotides prevent transcription of the rRNA operons.

a) attenuator
b) Riboswitches
c) stringent factor
d) sigma factor

186) ---------- are gene-control elements that share some of the characteristicsof the attenuation mechanisms, RNA thermometers and T-boxes but thedistinctive feature of these is that they can bind and sense the presence ofcertain metabolites.

a) attenuator
b) Riboswitches
c) stringent factor
d) sigma factor

187) Replication of male-specific phage (MS2) requires an----------, an enzyme not normally present in bacterial cells.

a) DNA polymerase 1
b) gamma DNA polymerase
c) RNA polymerase 2
d) RNA-directed RNA polymerase

188) Bacteriophage T4, a virulent bacteriophage of *E. coli*, contains a ----------of about 165 kb. This molecule is slightly longer than that neededto contain the complete phage genome.

a) linear RNA molecule
b) linear DNA molecule
c) circuler DNA molecule
d) circuler RNA molecule

189) Bacteriophage *λ* particles, contain ----------

a) linear RNA molecule
b) linear double-stranded DNA
c) circuler DNA molecule
d) circuler RNA molecule

190) Which of the following is true for antigenic variation of gonococcal pili:

a) The *pilS* locus contains several different copies of the gene, all lacking a promoter
b) Antigenic change occurs by replacement of part of the expressed gene (at *pilE*) by a copy of the equivalent part of a previously silent gene.
c) Recombination between the conserved regions at the 5_ end of inverted copiesof *sapA*causes inversion of the control region.
d) a and b are correct

191) Which of the following is true for plasmid pBR322:

a) constructed by Bolivar and Rodriguez
b) constructed from the ColE1 plasmid
c) derivative number 322 of the plasmids they constructed.
d) All the above are correct

192) pBR325 is:

a) pBR322 with a chloramphenicol resistance gene inserted
b) The new number, 325, distinguishes the plasmid from pBR322.
c) pBR322 with a kanamycin resistance gene inserted
d) a and b are correct

193) The Tol plasmid coding for:

a) The degradation of toluene
b) tumor induction in plants
c) Nodulation on roots of legume plants
d) Antibiotic methylenomycin biosynthesis

194) Some plasmids of Gram-positive bacteria, including the *Staphylococcus* plasmid pT181, use antisense RNAs to regulate transcription of the *rep* gene, in this case called *repC*, through a process called:

a) complementary
b) attenuation
c) Regulation by coupling
d) Regulation of transcription

195) ----------promotes recombination between specific sites on the plasmid if the same site occurs more than once in the molecule, as it would in a dimer or multimer.

a) A regulation by coupling
b) Attenuation
c) A site-specific recombination system
d) All the above are false

196) *Streptococcus pneumoniae*is maximally competent in the:

a) early exponentialgrowth phase
b) lag phase
c) under all conditions
d) a and c are correct

197) Which of the following is true for Tandem-duplication mutations :

a) play an important role in evolution
b) arise during the same ectopic recombination as deletions
c) occur within a single gene usually inactivate thegene and are not leaky
d) All the above are correct

198) When complementation occurs between two mutations that are in the same gene, This process referred as is called:

a) intragenic complementation
b) intergenic complementation
c) transacting mutation
d) Attenuation

199) If a mutationis complemented by a clone of a different genewhose product is being overproduced, this is called:

a) transacting mutation
b) multicopy suppression
c) silent mutation
d) complementation

200) A ----------is a collection of clones that, amongthemselves, contain all the DNA sequences of the organism.

a) gene cloning
b) gene manipulation
c) DNA library
d) gene therapy

201) ---------- the first plasmids discovered,when *Shigella* and *Escherichia coli* strains resistantto a number of antibiotics were isolated from the fecalflora of patients in Japan in the late 1950s.

a) F- plasmid
b) R - plasmid
c) Col plasmid
d) virulence plasmid

202) RNA-directed RNA polymerase, used in replication of some RNA viruses termed as:

a) RNaseH
b) replicase
c) TrpR
d) resolvase

ANSWERS

1) c) phosphodiester bond

2) d) a and b

3) b) a right-handed double helix

4) c) *oriV*

5) d) All of the above are correct

6) c) region of the DNA that codes for a single polypeptide chain

7) d) Two RNA molecules (23 S and 5 S) plus 31 different polypeptides.

8) a) single RNA molecule (16 S) and 21 polypeptides.

9) d) All of the above are correct.

10) b) to identify the number of sequences

11) c) amino acid starvation

12) a) over a range of 20–80%

13) a) *Micrococcus* has a high GC content (about70% GC), whereas *Staphylococcus* DNA has a low proportion of G + C(30–39%).

14) a) a linear DNA molecule of about 165 kb.

15) d) a and b correct

16) c) nucleoside

17) b) glycosylic bond

18) d) All of the above are correct.

19) b) hydrolyzed completely to their constituents

20) c) tautomeric state

21) b) 1.8

22) d) hybridization.

23) b) positively supercoiled

24) b) topoisomerases

25) a) anti-tumor agents in humans.

26) c) nucleoid

27) d) All of the above are correct.

28) c) 146 bp of DNA

29) b) chromatosome

30) a) less than 10 and more than 100 bp

31) b) protein.

32) a) metaphase (just before cell division)

33) c) telomeres

34) d) Euchromatin

35) b) cytosine base

36) d) All of the above are correct .

37) a) intron

38) c) polymorphs

39) b) restriction fragment length polymorphism (RFLP)

40) c) reverse transcription

41) a) protein contamination

42) a) the formation of local regions of dsDNA, formed by the base pairing of short regions of complementarity within or between DNA strands

43) d) DNA gyrase

44) a) histones

45) a) RNA editing

46) c) RNA polymerase

47) b) ribosomes

48) d) All of the above are correct

49) d) a and b are correct

50) b) splicing

51) b) replication fork

52) a) replicon

53) d) leading strand

54) a) DNA ligase

55) c) single stranded binding protein

56) b) DNA polymerase III holoenzyme

57) a) DNA synthesis phase

58) d) a and b are correct

59) a) snRNPs

60) b) the origin

61) d) a and b are correct

62) b) S phase

63) b) transition

64) b) UV light

65) c) depurination

66) a) methylmethane sulfonate

67) a) UV light

68) c) DNA photolyases

69) d) excision repair mechanism.

70) a) endonuclease

71) d) All of the above are correct

72) a) pyrimidine dimmers

73) b) DNA polymerases δ or ε.

74) a) meiosis

75) d) a and b are correct

76) b) DNA libraries

77) c) Mung bean nuclease

78) b) Positive electrode

79) c) recombinant DNA molecule

80) d) All of the above are correct

81) a) number of antibiotic-resistant colonies per microgram of input plasmid DNA.

82) a) size on an agarose gel and by excising the inserted fragment with the same restriction enzyme(s) used to insert it.

83) b) ATP

84) c) IPTG and X-gal.

85) c) multiple cloning site

86) b) up to 23 kb of foreign DNA.

87) d) b and c

88) a) 30–45 kb

89) d) All the above are correct

90) b) *Agrobacterium tumefaciens*

91) a) T-DNA

92) d) a and b are correct

93) d) All the above are correct

94) e) All the above are correct

95) b) linkers

96) c) polymerase chain reaction (PCR)

97) a) exonuclease III

98) d) All of the above are correct

99) b) RNA polymerase

100) a) RNA polymerase I

101) b) one each of the 23S and5S rRNAs

102) a) Jacob and Monod

103) b) galactoside permease

104) e) All of the above are correct

105) b) TATAAT

106) a) 40 and 60 bp.

107) a) between 5 and 8 bp

108) a) purine

109) b) transcription bubble

110) d) holoenzyme

111) c) TTGACA

112) c) 6 bp sequence

113) b) tight binding

114) d) b and c are correct

115) b) U

116) b) five

117) c) end-product inhibition

118) a) RNA hairpin

119) b) σ factor

120) d) σ^{70}

121) d) a and b are correct

122) b) 18S, 5.8S and 28S rRNAs

123) a) RNA polymerase I

124) a) $TAF_I s$

125) c) initiator element

126) d) a and c are correct

127) b) responsible for the synthesis of the precursors of 5S rRNA, tRNAs and other small nuclear and cytosolic RNAs.

128) d) All the above are correct

129) b) rRNA

130) b) 16S,5S and 23S rRNA sequences

131) b) endonuclease

132) d) a and b

133) a) RISC (RNA-induced silencing complex)

134) a) RNA interference

135) a) heterogeneous nuclear RNA (hnRNA)

136) b) 5^{-}-capping,

137) c) Alternative mRNA

138) a) codon

139) b) synonymous codons

140) a) 60–95 nt long

141) d) a and b are correct

142) c) Cloverleaf structure

143) b) aminoacyl-tRNA synthetase

144) d) Initiator tRNA

145) c) a free 30S subunit

146) b) mRNA

147) c) the charged initiator tRNA to bind

148) a) The 70S initiation complex

149) d) b and c are correct

150) b) transfer-messenger RNA(tmRNA)

151) c) Only one release factor (eRF)

152) a) eIF4B and eIF4F

153) d) All the above are correct

154) b) polyprotein

155) d) small single-stranded DNA

156) b) Oncogenes

157) c) Genomics

158) c) Tol

159) a) ColE1 plasmid

160) c) rolling-circle

161) a) *ori*sequences

162) d) All the above are correct

163) d) stringent plasmids

164) a) same incompatibility group

165) a) Rep protein

166) a) ColE1 plasmid

167) b) cured

168) d) partitioning

169) c) *parM* and *parR*

170) a) *sopC*

171) c) electrophoresed protein bands

172) c) Okazaki fragment

173) a) Northern blot

174) b) Open reading frame

175) a) Multiple cloning site

176) d) Antisense RNA

177) b) Aptamer

178) b) Auxotroph

179) c) Chaperone

180) b) Cistron

181) d) Epigenetic

182) a) RNaseH

183) c) Two-component regulation

184) a) PhoP-PhoQ

185) c) stringent factor

186) b) Riboswitches

187) d) RNA-directed RNA polymerase

188) b) linear DNA molecule

189) b) linear double-stranded DNA

190) d) a and b are correct

191) d) All the above are correct

192) d) a and b are correct

193) a) The degradation of toluene

194) b) attenuation

195) c) A site-specific recombination system

196) a) early exponentialgrowth phase

197) d) All the above are correct

198) a) intragenic complementation

199) b) multicopy suppression

200) c) DNA library

201) b) R – plasmid

202) b) replicase

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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