DEPARTMENT OF BIOTECHNOLOGY

BEST PRACTICE

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1. Title of the Practice - 5 MCQs – per week
2. Objectives
   - To enable the students to pay full attention in the class
   - To make the habit of noting down important points in the class.
   - To prepare them continuously for P.G entrance exams
   - To improve their cognitive skills
3. The context
   - With the revolution of computers and internet, students are loosing the habit of taking notes in the class
   - Usual pattern of Semester exams do not have MCQs, but all competitive exams are in MCQs form
   - Students need not have to prepare separately for P.G exams
   - Many students cannot afford to purchase practice books
   - Students need to be encouraged to take up carrier in applied life sciences
4. The Practice
   - Teacher gives 5 MCQs/fill in the blank questions per week.
   - Models question papers of various universities are also used.
   - Students can refer to their notes to answer the questions
   - The brief discussion that happen during question hour will give the feeling of summarizing the topic as well as repetition for slow learners
5. Evidence of success
   - Students feel confident to write various P.G entrance exams
   - Slow learners also tend to improve their learning abilities
   - Students have material for quick revision for their P.G entrance exams
6. Problems encountered and Resources required
   - If some students were absent for a class, they fail to attempt the questions
   - Model question papers of various P.G entrance exams, CSIR, UDC-NET exams etc.

5 MCQs – per week

Course with course code : Molecular Biology BT5310		Class : III B.SC BT.BC.C &BT.B.C
Semester : V		Month & Week: JULY - I wk
Topic : Nucleotides are the Precursors for DNA Synthesis		
S.No	Questions	Answer with explanation
1.	The nitrogenous base is covalently linked to the which carbon of the pentose sugar. a) C1 b) C2 c) C3 d) C4	Answer: a Nucleotides are phosphate esters of a five carbon sugar, either ribose of 2'-deoxyribose. The nitrogenous base is covalently linked to the C1 carbon of this pentose sugar to form the nucleotide.
2	Which of the following is not a part of a nucleotide? a) Ester linkage b) Phosphate group c) Base d) Hydrogen bond	Answer: d Nucleotides are phosphate esters of a five carbon sugar, either ribose of 2'-deoxyribose. The nitrogenous base is covalently linked to the C1 carbon of this pentose sugar to form the nucleotide. Hydrogen bond is made by the bases to hold the two strands of DNA together and is not a part of the nucleotide.
3.	In which carbon do the deoxyribonucleotides lack an –OH molecule? a) C1 b) C2 c) C3 d) C4	Answer: b A deoxyribonucleotides lack an –OH molecule at the C2 position of the ribose sugar ring. This is the substrate for DNA synthesis and is known as the 2'-deoxyribonucleotide
4.	Which of the following is not a nucleotide? a) AMP b) TMP c) GMP d) CMP	Answer: b TMP is not a nucleotide. Thymine is not present in form of Thymidine monophosphate as it is not used in RNAs. Thymine is present in the form of dTMP deoxythymidine monophosphate as it is used in the synthesis of DNA only.
5.	Which of the following is not a part of a nucleoside? a) Deoxyribose sugar b) Glycosidic linkage c) Phosphate d) Base	Answer: c A nucleoside is the deoxyribose sugar linked to the base with a glycosidic linkage. Addition of a phosphate at the 5'-carbone leads to the formation of the nucleotide

Course With course code : Molecular Biology BT5310		Class : III B.SC BT.BC.C &BT.B.C
Semester : V		Month & Week: JULY & III WK
Topic: DNA Replication		
S.No	Questions	Answer with explanation
1.	Replication of chromosome occurs during which phase. a) G1 b) S c) G2 d) Division	Answer: b Replication of chromosome occurs during the S – phase of the cell cycle. During this time all the DNA is duplicated exactly once. Incomplete replication of any part causes inappropriate links between daughter chromosomes.
2	How many origin of replication are present in the E. coli genome a) 1 b) 100 c) Uncountable d) None	Answer: a The E. coli genome has only one origin of replication, thus only one replicon. The eukaryotic genome has multiple origin of replication sites, thus have a multiple replicon system. The origin of replication in E. coli genome is known as the ori C.
3.	The origin of replication is rich in a) A, T b) G, C c) A, G d) C, T	Answer: a The origin of replication is an A, T rich segment of DNA which unwinds readily but not spontaneously. Unwinding of DNA at this region is controlled by the replication initiation proteins
4.	The topological unlinking of DNA in prokaryotes is promoted by a) Helicase b) Topoisomerase c) Tus d) Dna C	Answer: b The final step in prokaryotic DNA replication is the topological unlinking of the parental DNA strands. This process is catalyzed by topoisomerase.
5.	Which enzyme is used to remove the primer from the Okazaki fragment? a) Endonuclease b) RNase H c) 5’ exonuclease d) Polymerase	Answer: d Primer used for prokaryotic replication of lagging strand is a DNA primer thus RNase H and 5’ exonuclease is not used. Endonuclease is used for producing restrictions within the strand. Thus to remove DNA primer polymerase is used in the prokaryotic organisms

Course With course code : Molecular Biology BT5310		Class : III B.SC BT.BC.C &BT.B.C
Semester : V		Month & Week: JULY &II wk
Topic: DNA as genetic material		
S.No	Questions	Answer with explanation
1.	1. How is the genetic material expressed? a) By replication and transcription b) By transcription and translation c) By translation and modification d) By mutation and transposition	Answer: b Expression of the genetic material is the series of processes how the sequence of bases in the DNA directs the production of the RNAs and proteins that perform cellular functions and define cellular identity. The basic processes responsible for gene expression are transcription and RNA processing followed by translation.
2.	The bacterial system has _____ RNA polymerases. a) 1 b) 2 c) 3 d) 4	Answer: The bacterial system has 3 RNA polymerases. They are RNA polymerase I, RNA polymerase II and RNA polymerase III. RNA polymerase I transcribes mRNAs, and RNA polymerases II and III transcribes the other specialized RNAs.
3	Which RNA polymerase deals with the production of mRNA? a) RNA polymerase I b) RNA polymerase II c) RNA polymerase III d) RNA polymerase IV	Answer: a Polymerase I is responsible for the transcription of the different types of rRNA except the 5S rRNA. 5S rRNA is transcribed by polymerase III along with some small nuclear RNA genes and the tRNAs. Polymerase II deals with the transcription of the mRNAs.
4	The RNA polymerase holoenzyme has the structural formula of _____ a) α2ββ'ωσ b) αβ2β'ωσ c) α2ββ'ω d) α2ββ'σ	Answer: a In a complete RNA polymerase, called the holoenzyme there are 5 sub units. Of which two are α and one of the each of the other 4 subunits namely β, β', ω and σ.
5	The α subunits of polymerase has a function of _____ a) Promoter binding b) Initiation c) Elongation d) Termination	Answer: a The α subunits of polymerase is required for the core protein assembly, but has no clear role in transcription assigned to it. However, this subunit plays an important role in promoter binding.

Course With course code : Molecular Biology BT5310		Class : III B.SC BT.BC.C &BT.B.C
Semester : V		Month & Week: JULY & IV Wk
Topic: Initiation of Transcription		
S.No	Questions	Answer with explanation
1.	What is the consensus sequence of the Pribnow box? a) TATATA b) TATAAT c) TAATA d) TTAAT	Answer: b The Pribnow box is also known as the –10 promoter site. It was first recognized by Pribnow in 1975. It has a consensus sequence of TATAAT.
2.	The –35 sequence is highly conserved and has a consensus sequence of a) TGACAA b) TCGAA c) TGCAAC d) TTGACA	Answer: d The –35 sequence is highly conserved in efficient promoters and has a consensus sequence of TTGACA. The first three positions of this hexameric sequence are the mostly conserved.
3	–10, – 35 and +1 sites are the consensus promoter sites of sigma factor _____ a) σ70 b) σ32 c) σ54 d) σ28	Answer: a Different sigma factors recognize different promoter sites. As σ70 sigma factor is the most common sigma factor the highly studied –10, – 35 and +1 sites of promoter belongs to it
4	Negative supercoiling enhances the rate of transcription. a) True b) False	Answer: a Negative supercoiling enhances the rate of transcription of many genes. This is because it facilitates the unwinding of the DNA duplex by the RNA polymerase
5	The Pribnow box is present on the coding strand of the DNA template. a) True b) False	Answer: b The Pribnow box or the –10 sequence is present in the sense strand of DNA duplex. The sense strand is also known as the non – coding strand. It also harbors the other two conserved sequences for polymerase binding.

Course With course code : Molecular Biology BT5310	Class : III B.SC BT.BC.C &BT .B.C
Semester : V	Month & Week: AUG & I wk
Topic: Termination of Transcription	

S.No	Questions	Answer with explanation
1.	The stem of the hairpin loop of RNA consists mostly of a) A, T b) G, C c) A, G d) C, T	Answer: b The stem of the hairpin loop of RNA consists mostly of G, C. This makes the structure more stable and thus facilitating proper termination
2.	The rho protein has how many subunits. a) 4 b) 6 c) 8 d) 10	Answer: b The rho protein is a hexameric protein containing 6 subunits. This protein is known to mediate transcription and is known as the Rho dependent transcription
3.	The rho proteins are ATP independent proteins. a) True b) False .	Answer: b The rho protein is an ATP dependent protein. It uses the hydrolysis of ATP to terminate the transcription in the presence of a single stranded RNA
4.	The rho protein can even bind within operons to terminate transcription. a) True b) False	Answer: b The Rho protein fails to bind to any transcript of RNA that is being translated. Thus rho protein cannot bind within operons to terminate transcription and binds beyond the operon or gene to terminate transcription
5.	The hairpin structure generated in the RNA is followed by a stretch of oligonucleotide complementary to the base is a) A b) T c) G d) C	Answer: a The RNA hairpin is followed by a sequence of many “U” residues. Thus the complementary stretch of nucleotides in the DNA strand is adenine or “A”.

Course With course code : Molecular Biology BT5310 Class : III B.SC BT.BC.C &BT.B.C
Semester : V Month & Week: AUG & II Wk
Topic : Genetic code

S.No	Questions	Answer with explanation
1.	The codon is a a) Singlet b) Duplet c) Triplet d) Quadruplet	Answer: c The codon is a triplet. Singlet and doublet codes are not enough to code for 20 amino acids. Again in case of a quadruplet codon there will be 256 possible codons which are highly excessive. Triplet codon thus is the

		minimum requisite having 64 possible codons
2.	Which of the following is not a termination codon? a) UGA b) AGA c) AGG d) UAC	Answer: d UGA, AGA and AGG are termination codons of which UGA is the universal termination codon and AGA and AGG are mitochondrial termination codons. But UAC is the universal codon for tyrosine
3	In case of mitochondrial genetic code UGA Codes for a) Tryptophan b) Arginine c) Proline d) Stop	Answer: a In case of mitochondrial genetic code UGA is a tryptophan codon. But UGA is a stop codon in the universal genetic code.
4	There is one amino acid for one genetic code. a) True b) False	Answer: b In a triplet code for a particular amino acid more than one word can be used. This phenomenon is described by saying that the code is degenerate. A non – degenerate could be one where there is one to one relationship between amino acids and the codons so that 44 codons out of 64 will be useless or nonsense codons.
5	The distribution of codon is made in such a way to minimize mutation effect. a) True b) False .	Answer: a Inspection of the distribution of codons in the genetic code suggests that the code evolved in such a way as to minimize the deleterious effects of mutations. For instance, mutations in the first position of a codon will often give a similar, if not same, amino acid

Course With course code : Molecular Biology BT5310 Class : III B.SC BT.BC.C &BT.B.C
Semester : V Month & Week:
Topic :DNA as genetic material

S.No	Questions	Answer with explanation
1.	Which of the following statement is false about DNA? a) Located in chromosomes b) Carries genetic information from parent to offspring	Answer: c In case of eukaryotes DNA is abundantly found in nucleoplasm which is surrounded by the nuclear membrane. This structure is known as nucleus which

	c) Abundantly found in cytoplasm d) There is a precise correlation between amount of DNA and number of sets of chromosome per cell	is found in the cytoplasmic matrix. In case of prokaryotes DNA is found in a less dense cytoplasmic matrix known as the nucleoid
2.	Which of the following function of DNA is necessary for the purpose of evolution? a) Replication b) Transcription c) Translation d) Mutation	Answer: d Mutation facilitates the change of bases within a DNA and if this change encodes for a viable amino acid which in turn may lead to the synthesis of a different protein. This protein exerts a phenotypic character to the organism which may be different from the wild type character or may generate a unique character itself, thus leading to evolution
3	Fredrick Griffith's experiment involving Streptococcus pneumoniae lead to the discovery of a) DNA as genetic material b) RNA as genetic material c) Protein as genetic material d) Transforming principle	Answer: d When heat killed virulent (smooth) type bacteria were injected in the mouse along with the living avirulent (rough) type of bacteria the mouse developed the disease, which was an unlikely result. Moreover when the bacteria were isolated from the infected mouse they were found to be of the virulent type. Thus, it was believed that some factor from the heat killed virulent type bacteria transformed the avirulent to virulent type bacteria which was known to be as the transforming principle.
4	Definite results proving DNA to be genetic material was given by a) Fredrick Griffith b) Hershey and Chase c) Avery, Macleod and MacCarty d) Meselson and Stahl	Answer: c Avery, Macleod and MacCarty in their experiment with pneumococcus strains type IIIS and type IIR they performed three separate experimental setups:- i) Using DNase to degrade DNA ii) Using RNase to degrade RNA iii) Using Protease to degrade proteins Thus, when the separate combinations were injected into mice respectively the transforming principle was found to be DNA.
5	What stores the genetic information in DNA? a) Sugar b) Phosphate c) Nitrogenous base d) Polymerase	Answer: c Genetic information is stored in the sequence of nitrogenous base as they are of four types and they are A, T, G and C. The order of their occurrence decides the mRNA sequence which in turn codes amino acids and leading to synthesis of proteins. Sugars and phosphates form

		the backbone and are common to all, whereas polymerase helps in the replication of DNA template

Course With course code : Molecular Biology BT5310		Class : III B.SC BT.BC.C &BT.B.C
Semester : V		Month & Week: AUG &III wk
Topic : The Central Dogma Outlines the Flow of Genetic Information		
S.No	Questions	Answer with explanation
1.	Who were the first to suggest that one strand of DNA might act as a template for the synthesis of its complementary strand? a) Meselson and Stahl b) Watson and crick c) Walter Flemming d) Rosalind Franklin and Maurice Wilkins	Answer: b In Watson and Crick's paper on the model of DNA double helix they ended with a statement that it had not escaped their notice that the specific pairing they had postulated immediately suggested that one strand might be the template for the complementary strand synthesis.
2.	Which of the following regarding the basic mechanism of gene expression is correct? a) DNA —> tRNA—> protein b) RNA —> cDNA —> mRNA—> protein c) RNA —> DNA—> mRNA —> protein d) DNA —> protein	Answer: b Gene expression is carried forward from DNA to mRNA (transcription) and mRNA to protein (translation). To this RNA can be converted to cDNA by reverse transcription. Then the process is carry forwarded in the same manner.
3	Which of the following does not take part in gene expression? a) Replication b) Transcription c) RNA processing d) Translation	Answer: a Replication is the coping of the gene in double but plays no role in the production of protein thus, expression of gene. Transcription is the production of RNA from DNA and RNA processing is used for stabilizing the RNA in cytosol ad excision of non-coding regions. Translation is the major process which leads to the formation of polypeptide chain.
4	Multiple copies of RNA could be formed at the same time. a) True b) False	Answer: a The RNA produced does not remain base paired to the template DNA strand and is displaced only by a few nucleotides behind the transcription site. Thus another RNA polymerase can attach itself to the DNA template facilitating multiple RNA production
5	Which of the following statements is true with respect to the DNA double helix? a) Composed of two or more polynucleotide chains	Answer: b The two strands having complementary base pairing have the same helical geometry but have opposite polarity. This is because

	b) The base pairs have opposite polarity c) Covalent bond exists in base pairing d) T is transcribed as U	the strands are held together are antiparallel in nature

Course With course code : Molecular Biology BT5310		Class : III B.SC BT.BC.C &BT.B.C
Semester : V		Month & Week: AUG & IV wk
Topic : Various Classes of RNA Have Different Functions		
S.No	Questions	Answer with explanation
1.	With respect to polycistronic mRNAs which of the following is wrong? a) Multiple ORFs b) Found in Eukaryotes c) Encodes proteins with related functions d) Multiple polypeptide chain	Answer: b Eukaryotes only contain 1 ORF per mRNA and are thus monocistronic. Polycistronic mRNAs are generally found in prokaryotes with 2 or more ORFs.
2.	What was the name of ribosome binding site? a) ORF b) P site c) A site d) Shine – Dalgarno sequence	Answer: d Upstream the ORF a 3 – 9 base pair sequence on the 5’ side of the sequence is identified as the ribosome binding site (RBS). This element is referred to as the Shine – Dalgarno sequence, named after the scientists who discovered it by comparing the sequences of multiple mRNAs.
3	Which part of the ribosome identifies the Shine – Dalgarno sequence? a) Protein b) 16S rRNA c) 23S rRNA d) 5S rRNA	Answer: b The Shine – Dalgarno sequence is identified by the 16S rRNA. The core of the 16S rRNA has the sequence of 5’…..CCUCCU…..3’ and is located near the 3’ end of the rRNA. Not surprisingly the prokaryotic RBS are most often the subset of sequence 5’…..AGGAGG…..3’. Thus, 16S rRNA is the one that aligns the ribosome with the mRNA.
4	Eukaryotic mRNAs recruit ribosomes using the Shine – Dalgarno sequence. a) True b) False	Answer: b Eukaryotic mRNAs recruit ribosomes using specific chemical modifications called 5’ cap. The 5’ end of the mRNA is capped with methylated Guanine nucleotide to the mRNA via an unusual 5’ to 5’ linkage. To this methylated Guanine three phosphates are added. This cap binds to the ribosome which then slides along the mRNA length to find the ‘AUG’ for start of translation.
5	With respect to the composition of ribosome which of the following is correct.	Answer: d There is a discrepancy in the sedimentation

	a) Ribosome is composed of 60S and 30S subunit b) Eukaryotic ribosome small subunit contains only one 16S rRNA c) 60S subunit consists of 5S rRNA and 23S rRNA d) 60S and 40S makes up the 80S ribosome	velocity of the subunits separately and as a whole. This is because of the fact that the sedimentation velocity is determined both by shape and size and hence, it is not an exact measure of mass. Prokaryotic ribosome consists of 50S and 30S subunit and the 30S subunit contains only one 16S rRNA. The 50S subunit consists of 5S and 23S rRNA

Course With course code : Molecular Biology BT5310		Class : III B.SC BT.BC.C &BT.B.C
Semester : V		Month & Week: SEP & I wk
Topic : Transfer RNA		
S.No	Questions	Answer with explanation
1.	The 3' end of tRNA is a) 3' CCA 5' b) 3' ACC 5' c) 3' CCG 5' d) 3' GCC 5'	Answer: b Explanation: All tRNA has a conserved sequence of 3' ACC 5'. This sequence is conserved so as to facilitate cognate amino acid binding
2.	How many loops are present in the clover leaf model of tRNA? a) 2 b) 3 c) 4 d) 5	Answer: c There are 4 loops and an acceptor stem in the clover leaf model of tRNA. The names of the 4 loops are ΨU loop, D loop, anticodon loop and the variable loop
3	Which of the following does not contribute to the stability of tRNA? a) Base and sugar – phosphate backbone interaction b) Hydrogen bonding c) Hydrophobic interactions d) Base pairing	Answer: c Due to the negative charge of the tRNA backbone, it is unlikely for the molecule to have a hydrophobic nature. Thus, hydrophobic interactions do not play any role in the structural stability of the molecule. On the other hand, the other interactions such as the hydrogen bonding leads to base pairing which leads to its classic clover leaf model
4	Why the variable loop is named so? a) Variable number of bases b) Variable region c) Multiple loops present d) Variability of presence	Answer: a The variable loop sits between the anticodon loop and the ΨU loop and its region is fixed. The name is so given because they vary in size from 3 to 21 bases.
5	Thymine is present in tRNA a) True b) False	Answer: a Some unusual bases are present in the tRNA for its improved functioning. One of such pos – transcriptional modification done enzymatically is the presence of thymine base in place of uracil in the primary structure.

Course With course code : Molecular Biology BT5310	Class : III B.SC BT.BC.C &BT.B.C

Semester : V	Month & Week: SEP &II WK
Topic : Genome Organization	

S.No	Questions	Answer with explanation
1.	In the beads on a string model, the bead is made up of _____ a) 6 histone proteins b) 8 histone proteins c) 6 histone proteins and DNA d) 8 histone proteins and DNA	Answer: b The “beads on a string” model is for the nucleosome. It consists of the 8 histone protein core or the bead and the DNA wound around imitating a string.
2.	How many types of histone molecules are found in nature? a) 3 b) 4 c) 5 d) 6	Answer: c Eukaryotic cells commonly contain five abundant histone molecules. They are named as H1, H2A, H2B, H3 and H4.
3	Association of DNA and histone is mediated by a) Covalent bonding b) Hydrogen bonding c) Hydrophobic bonding d) Vander Waals interactions	Answer: b Association of DNA and histone is mediated by a large number of hydrogen bonds, that is, ≈140 bonds. The majority forms between the protein and the oxygen of the phosphodiester backbone near the minor grove. Only 7 hydrogen bonds are made between the protein side chains and the bases in the minor groves of the DNA.
4	Which of the following is not a characteristic of nuclear scaffold? a) Associated with loops of 40 – 90 kb b) Topoisomerase I c) SMC protein d) Proteinacious in nature	Answer: b Two classes of protein contributing to nuclear scaffold have been identified, that are, topoisomerase II and SMC protein. Presence of Topo II as a protein associated with the structure can be proved when the cells are treated with drugs which results in DNA breaks at the sites of Topo II DNA bindings. The treatment generates DNA fragments of about 50 kb size
5	Which of the following regions promote histone – DNA association? a) A, T b) A, G c) G, C d) C, T .	Answer: A A:T rich DNA has an intrinsic tendency to bend toward the minor grove. Thus A:T rich DNA is favored in positions in which the minor grove faces the histone octamer. G:C rich DNA has the opposite tendency thus, is favored when the major grove faces away from the histone

		octamer