

1/12/2018

[This question paper contains 8 printed pages.]

(4)

Your Roll No.....

Sr. No. of Question Paper : 23 I

Unique Paper Code : 32491501

Name of the Paper : Concepts in Genetics

Name of the Course : B.Sc. (H) Biochemistry

Semester : V

Duration : 3 Hours

Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question No. 1 is compulsory.
4. Use of scientific calculator/log tables may be allowed.

1. (a) Define the following and explain their significance in genetic studies :

- (i) Maternal effect
- (ii) Consanguinity
- (iii) Merozygotes
- (iv) Variable expressivity



P.T.O.

- (v) Random genetic drift
- (vi) QTL
- (vii) Hemizygous
- (viii) Phenocopy
- (ix) Pseudoautosomal region
- (x) TDF (1.5×10=15)

(b) Fill in the blanks :

- (i) Chromosome fragment lacking a centromere is known as \_\_\_\_\_ .
- (ii) A phenotypic trait coded by an autosomal gene that shows zero penetrance in one sex is called \_\_\_\_\_ .
- (iii) A statistic used to test the goodness of fit of data to the predictions of a hypothesis is known as \_\_\_\_\_ .
- (iv) \_\_\_\_\_ is a cross between F1 and a homozygous parent. (1×4)

2. Differentiate between the following :

- (i) Translocation and inversion of chromosome segments
- (ii) Incomplete dominance and Co-dominance

(iii) Uniparental inheritance and Sex-linked inheritance

(iv) Allopatric and sympatric speciation

(v) Broad sense and narrow sense heritability

(3,3,3,3,2)

3. (a) In *Drosophila*, *Lyra* (*Ly*) and *Stubble* (*Sb*) are dominant mutations located at loci 40 and 58, respectively, on chromosome III. A recessive mutation with bright red eyes was discovered and shown also to be on chromosome III. A map is obtained by crossing a female who is heterozygous for all three mutations to a male homozygous for the bright red mutation (*br*). The data in the table are obtained.

Phenotype	Number
(1) <i>Ly Sb br</i>	404
(2) + + +	422
(3) <i>Ly</i> + +	18
(4) + <i>Sb br</i>	16
(5) <i>Ly</i> + <i>br</i>	75
(6) + <i>Sb</i> +	59
(7) <i>Ly Sb</i> +	4
(8) + + <i>br</i>	2



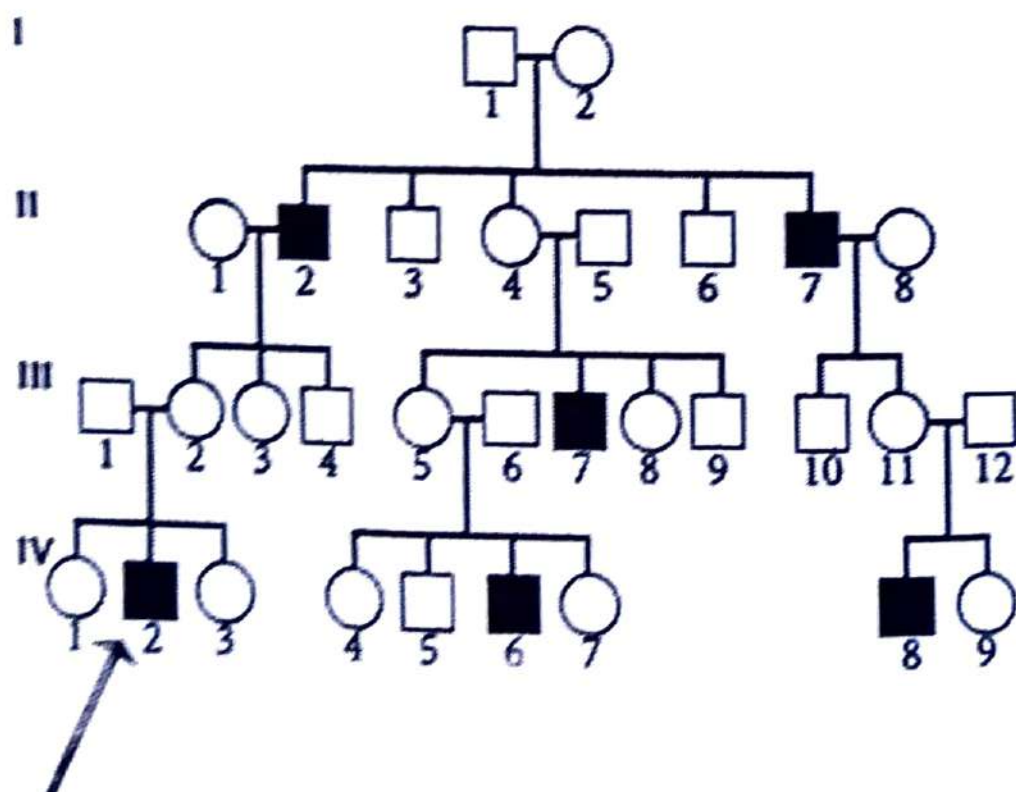


- (i) Determine the linear order of the genes on the chromosome.
- (ii) Construct the chromosomal map.
- (iii) Determine the coefficient of co-incidence and interference. (2,3,2)

(b) What do you understand by trinucleotide expansion? How is it responsible for genetic anticipation? (4)

(c) The most important aspect of CLB technique in *Drosophila* is the absence of cross over between CLB and normal chromosome. (3)

4. (a) The following pedigree has been provided to you. Answer the following questions.



- (i) What does the individual with the arrow signify?
- (ii) What is the most likely mode of inheritance of the trait and why?
- (iii) What is the genotype of the affected individuals, II 4, III 2, and III5? (1,3,2)
- (b) In a family with 7 children, what is the probability of the following?
- (i) All the children are girls
- (ii) Five of the children are boys (3)
- (c) Explain how Benzer used complementation test to determine the structure of rII locus of T4 bacteriophage. (5)
5. Comment on the following statements :
- (i) Rare male calico cats are the feline equivalent of Klinefelter's syndrome.
- (ii) In certain types of genetic crosses, the genotype of the female parent determines the phenotype of the progeny, regardless of its own genotype.
- (iii) In the experiments conducted by Carl Correns on *Mirabilis jalapa*, the variegated branch produce progeny with three different phenotypes.



- (iv) Bridges experiment was conclusive proof for the chromosomal theory of inheritance.
- (v) Different phenotypes can result from different mutations in the same gene.
- (vi) Polyploidy in plants helps in gaining economically beneficial characters.
- (vii) The genetic map distance measured over a long interval of chromosome is generally underestimated.

(2×7=14)

6. (a) Explain somatic cell hybridization.

The following grid of data is provided to you.

Assign genes to their gene products based on the given data. Give reasons.

Hybrid cell lines	Human chromosomes present								Gene products expressed			
	1	2	3	4	5	6	7	8	A	B	C	D
23									-	+	-	+
34									+	-	-	+
41									+	+	-	+

(5)

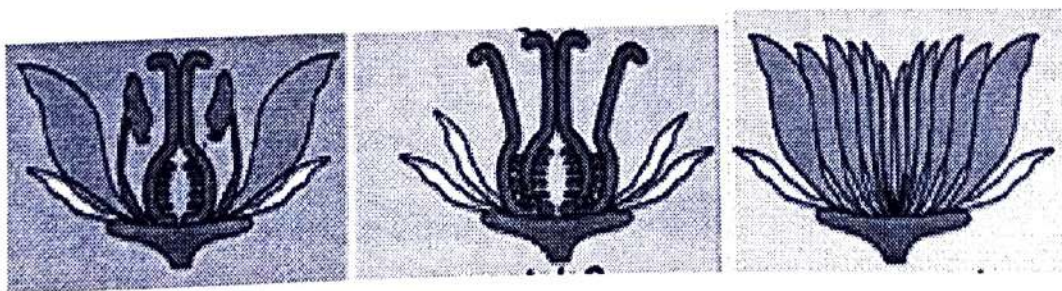
(b) Name the disorders associated with the following karyotype :



- (i) 47, +21
- (ii) 47, +13
- (iii) 47, +18
- (iv) 47, X
- (v) 47, XXY
- (vi) 46, 5p- (3)

(c) Protein and mRNA gradients are responsible for determining the A-P and D-V axis of the Drosophila embryo. Explain. (3)

(d) Below is the flower diagram of the wild type Arabidopsis flower and 2 mutants. Identify the three flower types. Explain the genetic basis for the mutations.



(3)

7. (a) Explain the basis of deviation from Mendelian dihybrid ratio. Taking a suitable example, discuss the biochemical pathway by which the following ratios may arise :

(i) 9:7

(ii) 12:3:1

(5)

P.T.O.



- (b) (i) A new born infant has ambiguous genitals and chromosomal studies shows that the karyotype was 46 XY. Based on your knowledge of sex determination in humans, propose a reason for the ambiguous genitals.
- (ii) How is sex determination in drosophila different from humans? (3,3)
- (c) Discuss the mechanism of conjugation. Which of the following matings cannot occur?
- $F^+ \times HFr$ ;  $F^+ \times F^+$  (3)

8. Write short notes on the following :

- (i) Mechanism of X chromosome inactivation
- (ii) Hardy-Weinberg Law
- (iii) Genomic imprinting
- (iv) Mechanisms of gene transfer in bacteria (3.5×4)





12/12/2018

[This question paper contains 6 printed pages.]

5

Your Roll No.....

Sr. No. of Question Paper : 24

I

Unique Paper Code : 32491502

Name of the Paper : Gene Expression and Regulation

Name of the Course : B.Sc. (H) Biochemistry

Semester : V

Duration : 3 Hours

Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Answer **five** questions in all including Question No. 1 which is compulsory.

1. (a) Explain the following :

(i) The tRNA molecules must have both unique and common structural features.

(ii) Oligonucleotides containing Shine Delgarno sequences inhibit translation in prokaryotes but not in eukaryotes.



P.T.O.

- (iii) Exons are shuffled by recombination to produce genes encoding new proteins.
- (iv) Eukaryotic mRNAs have a longer half-life than prokaryotic mRNAs.
- (v) Likely effect of a mutation that would prevent sigma factor from dissociating from the RNA polymerase core.

(b) What do you understand by the following terms :

- (i) Catabolite repression
- (ii) Translocation
- (iii) Promoter escape
- (iv) Inducer
- (v) Attenuation

(c) The following sequence of a duplex DNA segment in a DNA molecule is transcribed by the enzyme RNA polymerase.

5'---ATCGCTTGTTCGGA---3'

5'---TAGCGAACAAGCCT---3'



to give the RNA with the following sequence

5'---UCCGAACAAGCGAU---3'

Giving reason state whether the following statement about the DNA segment are True or False.

- (i) The top strand is the coding strand
- (ii) The bottom strand is the sense strand
- (iii) The top strand is the template strand
- (iv) The bottom strand is the antisense strand

(10,5,4)

2. (a) Differentiate between the following :

- (i) Lytic and lysogenic cycle
- (ii) Class I and class II Aminoacyl tRNA synthetases
- (iii) RNA polymerase I and RNA polymerase II

(b) Discuss the two types of transcriptional control mechanism for tryptophan biosynthesis. (9,5)

3. (a) Give the experiment that were the basis for the

P.T.O.

following :

- (i) The ribosome is unable to discriminate between correctly and incorrectly charged tRNA
- (ii) Protein synthesis proceeds from N-terminal to C-terminal
- (iii) The codon UUU was assigned to phenylalanine

(b) Give the anticodon sequence on tRNA molecule for the following codons :

CAG      GCU      (12,2)

4. (a) Explain the significance of the following :

- (i) Elongation factors in translation
- (ii) The genetic code is degenerate
- (iii) Cap structure of eukaryotic mRNA

(b) Elaborate the steps involved in the initiation of translation in prokaryotes. (9,5)



5. (a) Lac operon is under negative as well as positive control. Explain with the help of examples.
- (b) Aminoacyl tRNA synthetases are the only component of gene expression that decodes the genetic code.
- (c) How would you use a DNA endonuclease and RNA polymerase to locate a promoter site? (5,5,4)
6. (a) Write the mode of action of the following :
- (i) Puromycin
  - (ii)  $\alpha$ -Amanitin
  - (iii) Chloramphenicol
- (b) How does eukaryotic RNA polymerase II escape promoter and enter into elongation phase.
- (c) Synthesis of hemoglobin subunit is coupled to availability of heme. Explain. (6,4,4)
7. (a) Write the role of the following :
- (i) Rho factor in transcription
  - (ii) Riboswitches in gene regulation
  - (iii) GTP in protein synthesis



(b) Ribosomal proteins are translational repressor of their own synthesis. Explain. (9,5)

8. Write short notes on the following (**any four**) :

(a) Gene silencing by RNA interference

(b) SOS response in bacteria

(c) Processing of tRNA

(d) RNA editing

(e) CI repressor of lambda phage

(3.5×4)

