

Course Name : Epigenetics	Course Code : BIO 431
Date of Exam: 24-09-2018	Duration: 2 hours
Instructor: Sanjeev Galande	Total Score: 35 marks

Instructions:

- i. This question paper has 2 pages.
- ii. Use illustrations and/or examples whenever appropriate.
- iii. Be as concise as possible.

Q.1 Write short note on (2 marks each)**6 Marks**

1. ENCODE and advantages of publically available databases.
2. Evolution of Waddington's hypothesis over the years.
3. Advent of NGS and its impact on research in life sciences.

Q.2 Your lab is focused on understanding molecular mechanisms underlying cortex development during mouse embryogenesis. You started with whole genome screening approach using CRISPR cas9 and found that loss of two important transcription factors LHX2 and PAX6 results in the same phenotype. Now you need to further understand whether LHX2 and PAX6 regulate common sets of genes or are involved in different pathways. Design an experimental strategy for the following aims.

8 Marks

1. To identify common molecular pathways regulated by LHX2 and PAX6.
2. To identify direct targets of LHX2 and PAX6.
3. To determine whether regulation is through direct interaction or independent of each other.
4. Given the information that these two proteins regulate a common target neurog2; how would you determine if its regulation is through epigenetic mechanisms?

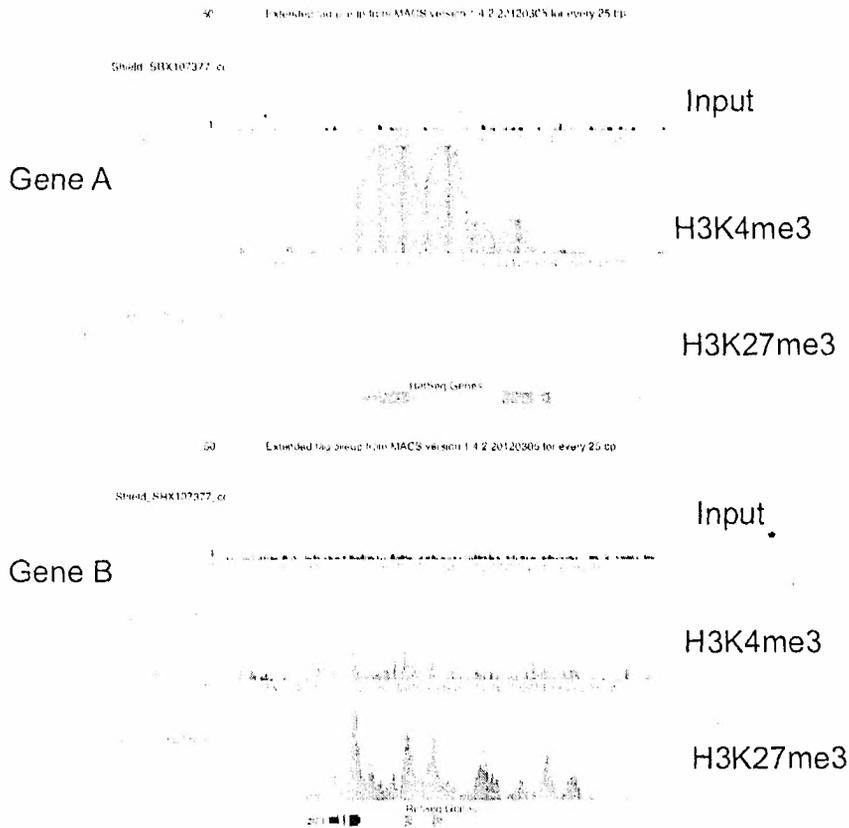
Q.3 A team of researchers conducted an experiment with alpha amanitin on zebrafish embryos. Embryos treated with alpha amanitin showed arrest at blastula stage. Since researcher knew in advance that alpha amanitin is an inhibitor of transcription they decided to look upon how modified form of RNA polymerases are positioned across genome upon the treatment. During the time of the project they identified another mutant for protein 'X' which also exhibit similar phenotypes. However computational studies revealed this protein does not bind directly to RNA polymerase and induce any conformational changes. How would you conduct an experiment to identify effect of loss of protein 'X' on genome-wide transcription and explain mechanisms with respect to transcription initiation and transcription elongation? Also given the information, it does seem to affect the transcription rate, explain the possible mechanisms.

6 Marks

Q.4 A team of researchers obtained ChIPseq data for two histone modification marks. When overlaid on each other they observed the following pattern for genes A and B. Comment on the transcription/expression status of both the genes.

4 Marks

Q.5 What are the advantages of alternate splicing for a cell? How histone modifications affect alternative splicing? **5 Marks**



Q.6 Explain the difference between paused and poised genes and how would you characterize them? **2 marks**

Q.7 A group of researchers isolated two HATs. They performed in-vitro acetylation assay using various core histones as substrates. The following results were obtained:

	HAT 1				HAT 2			
	H2A	H2B	H3	H4	H2A	H2B	H3	H4
kDa								
12			■	■			■	
								ac-H2/H3/H4

- Briefly explain the results. What is the difference between the two enzymes being studied?
- Which region within the histone would get modified by these enzymes and why?

4 marks

Points: Serotonin? Amy