Molecular Biology and Genetics (BEL204)

Major Test

Duration: 2 hours | Total Marks: 40 | Date: May 6, 2009

Answer all the Questions

1. How could you experimentally verify if DNA replication was continuous rather than discontinuous? Give answer with justification for the specific condition of the experiment that you feel important and also reason for what would be the result if such condition was not followed. **4**

2. a) What would you use to radioactively label protein, DNA and RNA of growing cells? If you were to label histones, what should be the ideal labelling molecule to use for such purpose and why? **1**

b) Certain reagents, called protein crosslinking agents, can covalently link proteins which are closely placed such as the histone octamers so that they cannot be separated. To check if nucleosomal octamers remain intact during cell multiplication or not, growing cells were heavily labelled with radioactive histones, crosslinked and isolated core particles. These were then subjected to density gradient centrifugation in sucrose and various fractions were checked for core particle. What parameter would you monitor in the ordinate against fraction numbers in the abscissa? How the gradient fractions would look like if old histone octamers remain i) intact or ii) dissociate during new DNA and histone synthesis? Give reason for your answer. **3**

3. A number of nutritional mutant strains were isolated from wild type *Neurospora* that responded to the addition of certain supplements in the culture medium by growth (+) or no growth (0). Given the following responses for single-gene mutants, diagramme a metabolic pathway (using the abbreviations below each supplement) that could exist in the wild type strain consistent with the data, indicating where the chain is blocked in each mutant strain. **4**

	Supplements added to the minimal growth medium				
Strain	Citrulline (Cit)	Glutamic semialdehyde (GSA)	Arginine (Arg)	Ornithine (Orn)	Glutamic acid (GA)
1	+	0	+	0	0
2	+	+	+	+	0
3	+	0	+	+	0
4	0	0	+	0	0

4. Between mitosis and meiosis, which one can be used as evidenc4e in support of Mendelian laws and how? Similarly, in a certain species of grasshopper, presence of heteromorphic pair of chromosomes was of help in support of Mendelian laws. Explain. **4**

P.T.O.

5. List the different types of possible mutants of *lacI*. What are the observable effects of these mutants on the expression of lac *ZYA*. What can you conclude from such observations about the *lacI* gene in terms of its dominant/recessive and cis/trans character? **5**

6. In a study involving a cell-free protein synthesizing system from *E.coli*, the polyribonucleotide AUGUUUUUUUUUUU lets the synthesis of peptide …-Phe-…-…-…. In the presence of Bruce-Lee-O-mycin, a new antibiotic, only the dipeptide "...-Phe" is made. **8**

a) What polypeptide product is expected in the absence of Bruce-Lee-O-mycin?
b) What step in polypeptide synthesis does Bruce-Lee-O-mycin inhibit? Explain your answer.
c) What peptide product be found attached to tRNA at the end of the uninhibited reaction?
d) Will the inhibited dipeptide product be found attached to tRNA at the end of reaction?

7. For each of the following five components of the splicing process, indicate whether it is a protein, RNA or Both. Then briefly explain how each of the five fits into the splicing process. **5**

a) snRNA
b) Spliceosome
c) snRNP
d) splice sites
e) Lariat

8. Write short notes about any three of the following **6**

a) transcription termination in prokaryotes
b) transcriptional regulation by attenuation
c) difference between eukaryotic and prokaryotic translation initiation
d) degeneracy and universality of genetic code
e) type I and type II introns
