2015

BIOCHEMISTRY

Paper – BCO – 401

(Molecular Recognition)

Full Marks – 25

The figures in the margin indicate full marks

Candidates are required to give their answers in their own words as far as practicable

1. (a) Schematically illustrate the experimental layout showing that the ingredients of the cytosolic complexes in presence and absence of Wnt signal are different. 4

(b) mRNA of some maternal genes are responsible for polarity development of an embryo. Briefly explain with an appropriate example. 4

(c) Name the mammalian homologue of dpp. How does morphogen gradient influence developmental program? Explain this using dpp as an example. $\frac{1}{2}+2+2$

Or

2. (a) Use an experimental layout to show that 3'-ends of some mRNAs are important in determining their polar location in an embryo. (**Use any one example**). How would you demonstrate polarity determination starts in the unfertilized eggs itself? $3+1\frac{1}{2}$

(b) What are twist and hunchback? How are they regulated? How do you show their time of expression? $(1+1)+(1\frac{1}{2}+1\frac{1}{2})+(1\frac{1}{2}+1\frac{1}{2})$

Group – A

3. Answer ***any two*** questions : 3×2

(a) Scaffold proteins bind to multiple binding partners simultaneously. Suppose you have discovered a new scaffold protein S that binds both molecules A and B (with no independent interaction being present between A and B). A particular signal transmission dependes on the concentration of the trimolecular complex A-S-B. Draw a graph that shows the relationship between signal output and the concentration of the scaffold protein. Identify the concentration conditions under which the signal output will be maximal. How would you expect the signal output to be affected if S is overexpressed to a level much higher than normal? Explain your answers. 1+1+1

(b) A protein domain recognises a peptide with the following sequence profile: RxxF/L/VxF (the residues F, L, V at position 4 are recognised with equal affinity; x denotes that any amino acid is tolerated at that position). A homologous protein domain recognises peptides with the profile RxxVxF. Which domain has higher specificity? Which domain will bind with higher affinity? Explain your answer. $(1\frac{1}{2}+1\frac{1}{2})$

(c) Explain how post translational modifications regulate p53 stability and activity during genotoxic conditions. 3

Group – B

4. Answer ***any two*** questions :

(a) In analysing how a cell responds to stress, you discover several induced phosphorylation events on a protein, X. Phosphorylation of Protein X on Thrl22 induces its interaction with protein Y. Discuss two possible alternative mechanisms by which this modification might induce binding to protein Y (include a schematic representation of the proposed mechanisms). $2\frac{1}{2}$

(b) You are analysing and SH2-phosphtyrosine peptide interaction and find that the K_d for the unphosphorylated peptide is lmM, while the K_d for the phosphorylated form is l00nM. This peptide is found on the C terminal tail of a receptor tyrosine kinase that is expressed at low levels. What might be the approximate concentration range for the SH2 containing protein in the cell? Give reasons for your answer. $1+1\frac{1}{2}$

(c) (i) How do BMAL-CLOCK and RevB regulate each other?

(ii) What features of the UIM enable ligand recognition?

(iii) How does a single phosphorylation event in the T-loop of a CDK lead to significant alteration of its conformation? $1+\frac{1}{2}+1$

5. Illustrate the important features of ***any one*** : $1\frac{1}{2}$

(a) Bromodomain

(b) Chromodomain

(c) SH2 domain

(d) UIM.