2022

1st Semester Examination

ZOOLOGY

Paper : ZOOL 104

Full Marks : 40 Time : Two Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Paper : 104.1

(Cell Biology)

1. Answer any ***two*** questions of the following : 2×2=4

   (a) Suppose that you have isolated a mutant G_α subunit that has an increased GTPase activity. What effect would this mutation have on the G protein and the effector protein?

   (b) What roles do the SH_2 and SH_3 domains play in function of GRB_2?

   (c) What is augmin complex? State its function.

   (d) State the role of Plks in activation of Cdc 25.

2. Answer any ***two*** questions of the following : 4×2=8

   (a) *Briefly describe the* activation and inactivation

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stages of APC during the phases of cell cycle. State the role of APC in cell cycle regulation. 2+2

(b) (i) Na^+ ions are smaller than K^+ ions. How, then can a channel protein exclude smaller Na^+, yet allow passage of larger K^+? 2+2

(ii) Provide a brief account of ATP powered pumps.

(c) Describe the molecular mechanisms of GPCR-desensitization. What effect would a mutant receptor (RTK) laking tyrosine phosphorylation sites on cell? 2+2

(d) How do microtubules stabilize by side binding proteins? State the role of MARK/Par-1 in regulating MAP activity. 2+2

3. Answer any ***one*** question of the following : 8×1=8

(a) (i) The *Rb* protein has been called the master bake of the cell cycle. Describe how, the *Rb* protein acts as a cell cycle brake. How is the brake released in mid to late G_1 to allow the cell to proceed to *S* phase?

(ii) Explain how the following mutations which are found in some cancer cells, lead to bypass cell cycle control.

(a) Loss of p^{16} function

(b) Constitutive active Ras 5+1½+1½

(b) (i) A mutation was induced at the phosphorylation site of *CaM* kinase. Ca^{+2} influx occurred within the cell. Illustrate the activation and deactivation process of *CaM* Kinase having the said mutation. 5+3

(ii) Following a receptor-ligand crosslinking nuclear translocation of MAPK dimer was observed. Briefly describe the upstream cytoplasmic phenomenon with flow diagram.

Paper : 104.2

(Cytogenetics)

4. Answer any ***two*** questions of the following : 2×2=4

(a) If a bacterial strain bearing a mutation (*X*) that prevents it from growing on medium lacking amino acid *X* is to be changed into wild type, what experiments would you perform to ensure that this change occurs through transformation / conjugation / transduction?

(b) A streptomycin sensitive Hfr strain of *E.coli* of genotype a^+ b^+ c^+ d^+ e^+ was mated with a streptomycin resistant F^- strain of genotype a^- b^- c^- d^- for a period of 30 minutes. Bacteria of e^+ type were selected for survival colonies and the following frequencies of other + genes were found : 70% were a^+, No b^+ found, 85% were c^+, 10% were d^+. What is the gene order?

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(c) The gamma-globulin portion of human blood serum may be classified into Gm^{a+} and Gm^{a-} is dominant over Gm^{a-}. Assuming that Hardy-weinberg equilibrium is established. What are the frequencies of heterozygote in the populatin : 293 tested, Gm^{a+} 77; Gm^{a-65}.

(d)

No of phototrophs
B^+ M^+ T^+ P^+

$B^-M^-T^+P^+V^r$ (x) $B^+M^+T^-P^-V^S \rightarrow V^r = 49\ V^s = 8$

$B^-M^-T^+P^+V^s$ (x) $B^+M^+T^-P^-V^r \rightarrow V^r = 5\ V^s = 19$

State whether the gene for viral resistance segregate independently.

5. Answer any ***two*** questions of the following : $4\times2=8$

(a) Among 361 Navaho Indians tested in New Mexico. Boyd reported 305 of blood type M, 52MN, and 4N. Calculate the departure from genotype equilibrium frequencies and its significance (at 5 percent level) using chi square.

(b) Two independently discovered strains of mice are homozygous for a recessive mutation that causes the eye to be small, the phenotypes of the two strains are indistinguishable. The mutation in one strain is called little eye and the mutation in other is called tiny eye. A third strain is heterozygous for a dominant mutation that eliminates the eye altogether, the mutation in this strain is called