2018 Mutation STQ MS

2018 / H2 / IJC PRELIM / P2 Q4

1 Crossing over between homologous chromosomes is an important process that gave rise to genetic variation.

Errors during crossing over can result in abnormal chromosomes that will affect the phenotype of an organism.

Fig. 4.1 show the result of an unequal crossing over event in prophase I.

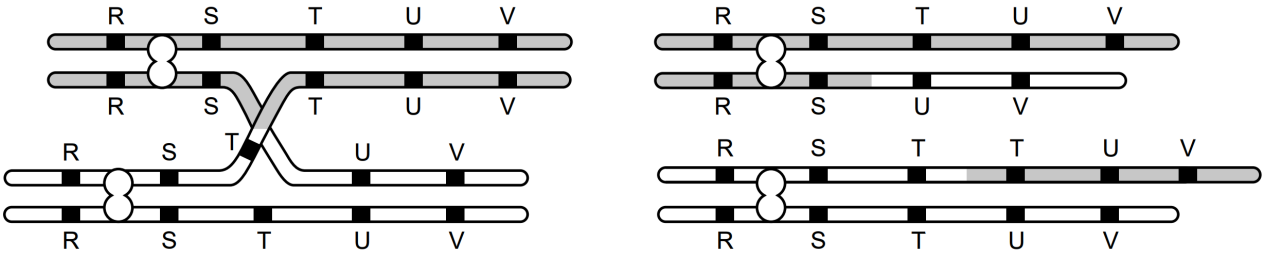

Fig. 4.1

(a) **(i)** State the type of mutation that has occurred in Fig. 4.1.

duplication of chr segment T / deletion of chr segment T; [1]

(ii) Suggest the possible effects on the phenotype of the organism if protein T is a hormone involved in metabolism.

duplication

1. ***more prot T pdc due to more mRNA transcribed from DNA template;***

2. ***higher metabolism > normal;*** ***OR***

deletion

3. ***no prot T pdc due to no gene T transcribed;***

4. ***lower metabolism < normal;*** [2]

gene T is a dominant allele, one copy is sufficient for expression into phenotype

(Any pair of answers)

Fig. 4.2 shows the human karyotype of one of the most common chromosomal abnormalities. The affected embryos or foetuses with this condition ended up in miscarriages in the first trimester.

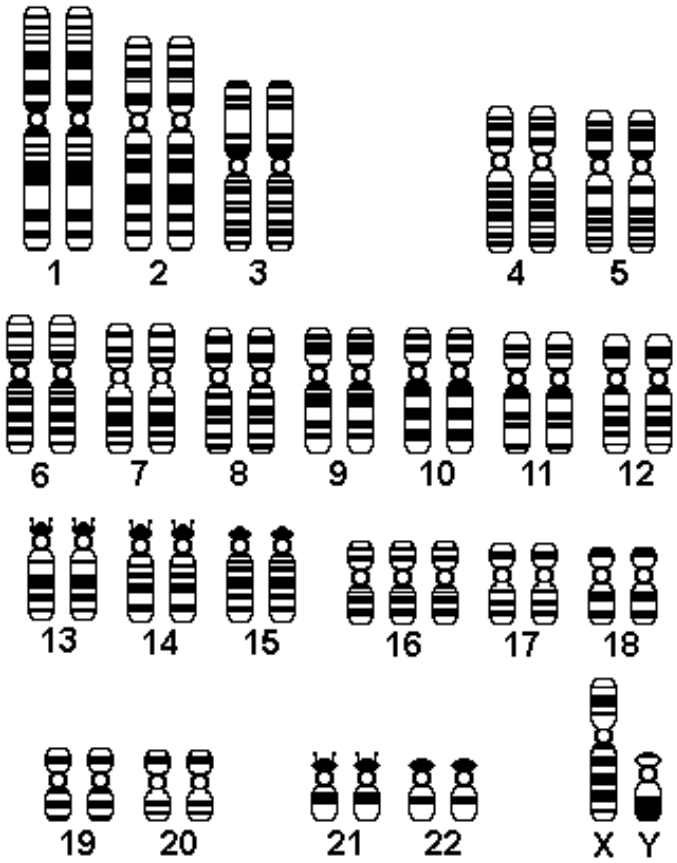

Fig. 4.2

(b) With reference to Fig. 4.2, explain how this condition arises.

1. ***trisomy 16 / w.t.e.;***

2. ***aneuploidy***

due to unequal separation of homolog chr (during anaphase I);

3. ***errors in spindle formation***

resulted in one (haploid) gamete with 2 copies of chr 16;

4. ***fusion with a normal haploid gamete***

restores diploid condition for all other chr pairs (except for chr 16); [4]

(c) Fig. 4.1 and Fig 4.2 are examples of chromosome aberration.

Use examples other than the ones shown, outline what does *chromosome aberration* mean.

1. ***changes to struc & nos of chr;***

2. ***struc aberration can be due to translocation***

exchange of chr segment b/w non-homolog chr; ***OR***

3. ***struc aberration can be due to inversion***

part of chr is cut out, reversed & reinserted back;

4. ***numerical aberration (of chr sets)***

unequal separation of chr sets resulting in polyploidy; [3]

[Total: 10]