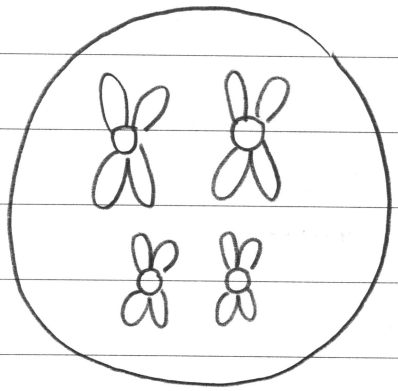
Start here.

(a)

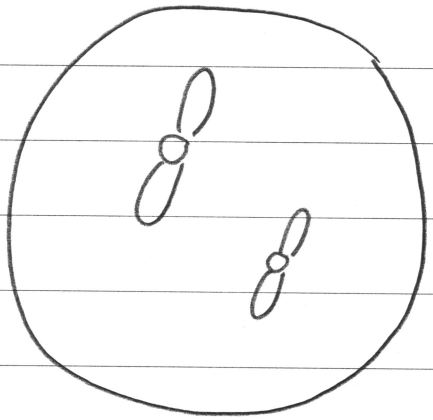
	Trisomy	Polyploidy	Base substitution
Definition	Non-disjunction in meiosis causing 3 homologous chromosomes	occurence of extra sets of chromosomes	Base of the gene changed with other bases.
Effect on chromosome number	Increases the specific homologous chromosome number.	Increases the whole chromosome number significantly	Do not affect the chromosome number

(b)



Diploid cell.

$2n = 4$



Haploid cell from meiotic division

$n = 2$

(c)

(i) Vision defect - Recessive

Limb defect - Recessive

(ii) • If the genes were linked.

Parents 9 — 10

VvLl VVLl

keys

V Dominant allele for vision defect

v Recessive allele for vision defect

L Dominant allele for limb defect.

l Recessive allele for limb defect

Gametes vl VL

Fertilisation

	vl	vl
VL	VvLl	VvLl
VL	VvLl	VvLl

Offspring All VvLl, normal vision and limb.
(100%)

• If the genes were not linked

Parents 9 — 10

VvLl VVLl

Gametes Vl, vl VL, Vl

Fertilisation

	Vl	vl
VL	VVLl	VvLl
Vl	VVll	Vvll

Offspring VVLl, VVll, VvLl, Vvll

(normal vision, normal limb) (normal vision, affected limb) (normal vision, normal limb) (normal vision, affected limb)

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∴ Phenotype of the offspring.

normal vision normal limb : normal vision affected limb = 1 : 1

50% 50%

You may ask for an extra Writing Booklet if you need more space.

Start here.

(d)

(i) • Studying the crossing-over frequency between genes on a chromosome helps identify the relative position of linked gene.

- The further the distance between genes, the more ~~like~~ likely of occurence of crossing-over between chromosomes.

• Data on the percentage of the frequency of the crossing over occurring between genes is collected and by comparing them, it is possible to ~~d~~ construct a linkage map that shows the relative position of linked genes on a chromosome.

(ii) • Linkage map shows relative position of genes in relation to the frequency of crossing-over.

-> Human Genome Project require the exact position of genes on the chromosome.

• Linkage map is based on the introns, the junk genes

-> Human Genome Project tends to find the whole position of genes.

• Genes that are not linked can not be identified using linkage maps.

(e) • Gene cloning and understanding of gene cascades has led to the development of new applications of technologies such as producing a new artificial life form.

• Gene cloning is a process of making an exact copy of a gene. Using recombinant DNA technology, it is able to make an identical gene required by our needs. Recombinant DNA technology involves taking a gene in interest and combining it with a plasmid from a bacterium, using restriction enzymes to cut in matching ends and sticking them together by DNA ligase. This recombinant DNA is put back into the bacterium which undergoes rapid binary fission to clone the gene. This allowed us to create extra copies of genes that could be used to create a new life or in transplat of organs, or gene therapy (e.g. insuline for diabetics) when needed.

• Gene cascades induces chain reactions that stimulate the expression of genes (switching on or switching off) in the right order at exact place such as in development of limbs. Development of limbs in mammals are controlled by Homeobox genes, (HOX genes) that starts gene cascades, ~~a~~ and activates or restricts the expression of genes so that the limbs are formed in an orderly way from embryo buds to the extremeties. Understanding how these genes control development of structures in an organism and the order of such formation allowed us to develop ~~an~~ a technique to ~~expres~~ switch on or off specific genes

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at right time in exact order when creating a new life or parts of ~~an~~ organisms that could be used in transplants.

You may ask for an extra Writing Booklet if you need more space.