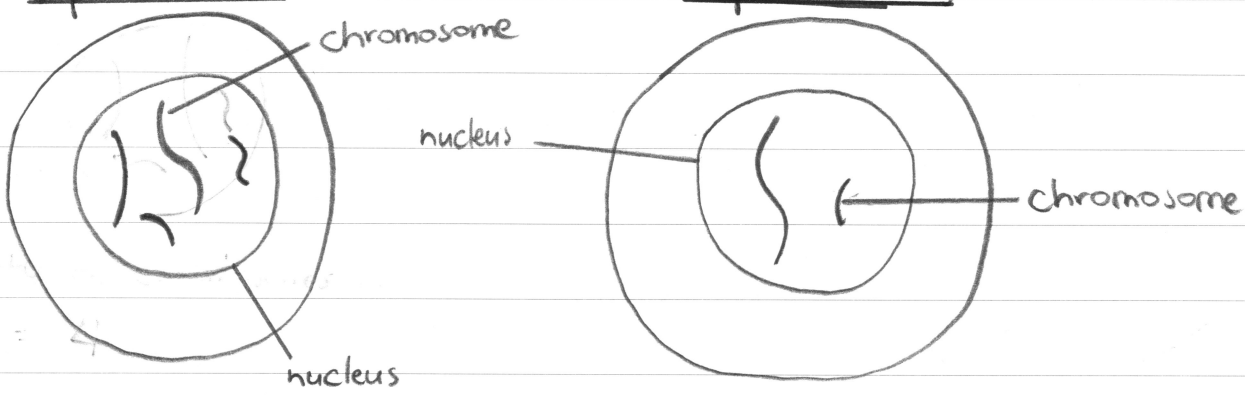
Start here.

a)

Mutation	Effect on Chromosome No.
Trisomy	Extra copy of one chromosome. eg in humans results in 47.
Polyploidy	Extra copy of every chromosome. Results in 3 sets of haploid number
Base Substitution	mutation of DNA sequence, therefore no effect on Number of chromosomes

b)



c) i. The genes for each defect are recessive.

ii. Let the alleles for Vision = V (dominant) v (affected recessive)

Let the alleles for Limb = L (dominant) l (affected recessive)

Parents = Vvll × V?Ll

V-L
V-l

Linked: Possible Genotypes = ~~VVLl VVll VvLl Vvll~~ × ~~VV~~ VL ~~vL~~ vl
OR
VL ~~Vv~~ VL ~~vv~~

Ratio	vl	vl
VL	VvLl	VvLl
vl	vvll	vvll

OR

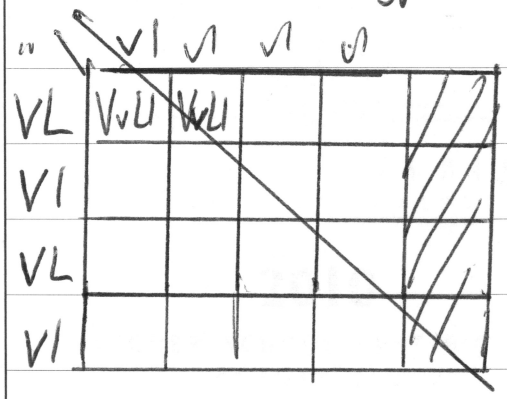
Ratio	vl	vl
VL	VvLl	VvLl
VL	VvLl	VvLl

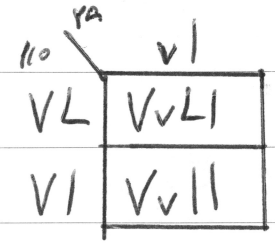
∴ Possible phenotypes of linked genes = 1 affected : 1 normal
1 normal : 0 affected

Not linked: vvll × V? L1

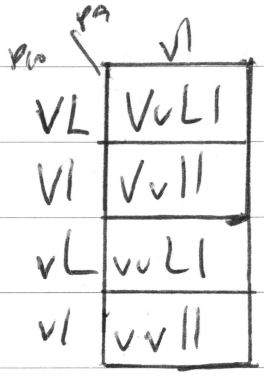
Possible Genotypes = vl vl vl vl × VL Vl VL Vl

VL Vl OR vL vl





OR



Possible Phenotype ratio : 1 normal : 1 limb defect

or 1 normal : 1 limb defect : 1 vision defect : 1 limb + vision defect.

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d) i. The relative position of linked genes may be identified through the analysis of recombination in the offspring of a cross. By calculating the percentage of recombination during crossing over is occurring is calculated, with the higher the percentage signifying the greater distance between the linked alleles on a chromosome is greater. For example, 5% recombination occurring means that the genes must be 5 units apart.

ii) 1. Linkage maps only address inherited genes, but gene sequence may be altered by mutations.

2. Linkage maps only identify the relative positive position of a gene on the chromosome, which would impact on the accuracy of the project.

3.

e) Through the study of DNA replication, and DNA structure, scientists have bee able to develop processes of gene cloning, ~~which~~ such as recombinant DNA technology, which allows for the manipulation and hybridisation of genetic information which is then copied through natural processes. Within recombinant DNA technology, Understanding of DNA base sequences made it possible to combine sets of genetic information from two different organisms by using the same restriction enzyme, which allows scientists to 'cut out' DNA sequences with complementary endings allowing them to be joined by DNA ligase. Due to the it's structure, and asexual reproduction, ~~DNA~~ bacteria is ~~often~~ used to form these recombinant DNA molecules, by joining a desired genetic sequence with plasmid. By reinserting the recombinant DNA molecule back into a bacterium, ~~it~~ the copies are formed as the bacteria undergoes binary fission, with the new genetic ~~life~~ trait being expressed. Understanding of this technology has enabled scientists to apply gene cloning for many ~~positive~~ medical uses, such as the production of insulin for diabetics, and the insertion of an artificial chromosome in surviving bacteria.

Understanding of gene cascades has also significantly led to the development of new scientific opportunities.

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Gene cascades is the process of one gene activating or deactivating the expression of another gene, ~~transversing~~, which leads to the gene differentiation and specialisation of another gene and so on. This for example, in the limb formation of chickens, the activation of the gene Tbx4 ~~dictates~~ activates the development of the limb bud into a leg, while Tbx5 dictates the development of a limb bud into a wing. By understanding this process, scientists are able to manipulate the development of an ~~artificial organ~~ structure, ~~from~~ and produce artificial ~~organs~~ structure from a single cell, such as the production of an artificial chromosome.

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