

I'm Kulkarni Rajender Rao from Government College of Arts, Science and Commerce Quepem. I'm going to explain sex linked inheritance part one from Mendelian Genetics and its extension.

Outlines of this module - X linked, Y linked, XY linked inheritance, dominant and recessive inheritance

Complete and incomplete sex linkage.

At the end of this module, you can distinguish between X, Y and XY linked inheritance. Differentiate between dominant and recessive sex linked inheritance. Understand the difference between complete and incomplete sex linkage.

Chromosomes in all the organisms are basically of two types. Autosomes and Allosomes.

Autosomes are also known as somatic chromosomes. In human being there are 22 pairs of autosomes

Allosomes are the chromosomes which are responsible for determining the sex, also known as sex chromosomes, one pair in human beings. In the female. They are XX in the male XY. female is homogametic. That is, it produces gametes in which all will have X chromosome, whereas the male is heterogametic which produces some gametes with the X chromosome, some with the Y chromosome.

When reciprocal cross is done, there is no change in the phenotypic ratio.

If the genes are present on the autosomes, if they are on the allosomes or sex chromosomes, there is a change in the reciprocal cross.

Sex linked inheritance is the transmission of characters or traits by the genes present on the sex.

Chromosomes or allosomes. The genes which are present on the sex chromosomes are called sex

linked genes and the characters which are expressed by the genes present on the sex chromosome are

known as sex linked characters. Genes are present. Only on X chromosome Then they are referred as an X linked genes or x linked characters and the mechanism by which these genes transmit the characters in the progeny is known as X linked inheritance.

Examples of X linked inheritance. is the haemophilia and colour blindness in human beings

Dominant sex linked inheritance. In homogametic sex that is. In human beings in the females.

In the birds it is males. Because in human being female will have two x chromosomes similar chromosomes. In the birds males will have a similar chromosomes. That is ZZ

In heterogametic sex it carries two different chromosomes It is referred as XY

Homozygous or heterozygous homozygous when it carries similar alleles. Heterozygous when it carry different alleles in heterogametic sex that is, males in human beings having XY chromosomes and females in the birds having Z W chromosomes.

They are hemizygous as they carry only one allele because in majority of the cases, the genes which are present on the X chromosome do not have alleles on the Y chromosome or W chromosome.

Dominant sex linked inheritance is expressed more in females.

Examples of dominant sex linked inheritance bar pattern in poultry and hypophosphatemia in humans.

Generally in human beings. The sons. Get x chromosome always from mother and Y chromosome only from Father. The daughters gets X chromosomes from both the parents. X linked dominant inheritance is more in females because they are homogametic If Mother is having mutant gene 50% of the sons and daughters are affected, 50% are normal.

If Father is having the X linked dominant allele, 100% daughters and zero per cent sons get the disorder. Let's assume sex linked recessive inheritance. To express it female requires two genes because female will have the two sex chromosomes and alleles are present on both the chromosomes. If one is dominant, this character will not be expressed. Therefore, recessive sex linked inheritance can be expressed only if both the alleles are present in the female. Male require only one allele or one gene because Y chromosome do not have the allele. Hence expressed more in heterochromatic males.

Example eye colour in drosophila, haemophilia, Colour blindness in men.

Pseudo dominance. Single recessive gene expression in absence of dominant gene. If genes are present on both X&Y chromosomes, it is referred as XY linked genes and the characters transmitted by these Genes are known as XY linked characters. The

mechanism by which the genes which are present on the XY chromosomes transmitting the characters in the progeny is known as XY linked inheritance.

X-Y linked chromosomes they are partially or incompletely sex linked because crossing over takes place in the homologous portions of X&Y chromosomes.

In this diagram you can see this particular portion in the red A&B. They are homologous. The genes if they are present here they may be exchanged that is, crossing over may take place because of this reason they are incompletely sex linked. Examples Xeroderma pigmentosum, Nephritis, Retinosa pigmentosa. If genes are present only on the Y chromosome. They are known as Y linked genes and the characters expressed by these genes are called Y linked characters and the mechanism,

Y linked inheritance; It is also known as holandric sex linkage that is totally confined to the male sex.

Because always Y chromosomes remain only with the male. Y chromosome is small in size.

Do not have all the alleles or loci of x. Only few genes are present on the Y and mostly they do not have homologous partners with the X chromosome and these genes, which are present only on the Y chromosome and transmitted only in the male. They are present under non homologous portions. They are confined to only males that will always pass from father to son. Example hypertrichosis and ichthyosis. Y linked sex linkage can be explained with this slide, here, no allele on the X chromosome. Alleles are present. Or genes present only on the Y chromosome OK from the affected father having the gene on the Y chromosome and unaffected mother the progeny will have affected sons and unaffected daughters because the Y chromosome is passed down to only the male progeny that is sons. Morgan in 1910 found a mutant, White eyed male and crossed with a wild variety red eyed female in *Drosophila*. All F1 progeny were red eyed, that is red is dominant over white.

On inbreeding, he obtained 3 red eyed and one white eyed. It is very interesting to note all the white eyed individuals in F2 progeny are males. If reciprocal cross is done. That is. Red eyed male is crossed with a

White eyed female in the F2 progeny. It was red eyed female, white male appear. The hypothesis. Morgan analysed it and concluded eye colour gene is located on the x chromosome. Male is hemizygous and white. So for them Genotype in the male. is WY. Female, maybe homologous or heterologous.

While red female Genotype will be  $W + W +$  that is homozygous red. In the F1 flies were  $W$  plus  $W$  plus females. The  $W$  plus  $Y$  males

Crisscross pattern of inheritance that is transmission of the mutant eye colour from Father to daughter.

From father to daughter, to grandsons. This is known as DIAGYNIC

The characters, if they are transmitted from Father to grandson through the daughters. And from mother to. Sons to granddaughters that is from mother. To granddaughters through the Sons is known as DIANDRIC

The same thing can be explained in this slide. Red eyed female crossed with the white eyed male in the parental generation. The Genotype of the parental generation is as given. like this and the gametes are here. When these gametes are placed in the checkerboard, you can see the combination like this.

That is, the red eyed female produces one gamete with the  $W$  plus that is red eye gene they're homozygous condition white eyed male will produce small  $w$  White gene and  $Y$  chromosome without any gene for the eye colour. When they crossed in the progeny you can see here the red eyed form here also red eye, both the male female. red eyed female and red eyed male. red eyed female and red eyed males appear in the equal ratio. When red eyed female is crossed with the red eyed male. Here the red eyed female is in heterozygous condition. The progeny will be having red eyed female and red eyed males and white eyed males. Here, interesting to note, only males will have the white eyes. In the reciprocal cross that is in a cross done between red eyed male and white female. In the parental generation. The gametes are like this. Male will produce the the  $W$  plus that is red eye and female produces  $w$ . That is white eye. when they're placed in The checkerboard and cross we can see the progeny will have red eyed females and white eyed males OK. Here all are red. When the white female is crossed with a white red male The progeny will show red eyed female, white eyed female, red eyed female white male that is both male and female will have the red and white eye in equal number.

Nesses Law - Nesses law states transmission of sex Linked characters or diseases from affected father to grandchildren .occurs through their daughters in crisscross pattern of inheritance. For example, haemophilia affects only boys, but is transmitted through mothers and sisters.

Here, some of the characters are the recessive characters, how they are transmitted in the progeny.

If unaffected Father gets married to the affected mother. Their children will have affected sons and carrier daughters.

If affected father and unaffected mother. Their children will have. Son will be unaffected. and Daughters will be carriers.

Unaffected fathers and carrier mothers of the recessive characters if they are married and their children will be having Unaffected son ,affected, Son, Carrier daughter and unaffected daughter. When both father and mother are affected, all the children are affected.

Coming to what is complete sex linkage?

X&Y chromosomes are not similar, X chromosome is large .Y chromosome is short. So they have several non homologous portions or heterologous. Most of the genes which are present on the X, they are absent on the Y and all the genes are present on the X. Chromosomes are linked and inherited together. There is no crossing over takes place because of this. This kind of inheritance is completely sex linked example Haemophilia and colour blindness. In case of incomplete sex linkage. In the X&Y chromosome, a small portion of the chromosome is having homologous nature and here the genes are present and they can undergo crossing over. There's no linkage for this region. There is the possibility of exchange between X&Y chromosomes and this kind of interference is known as incomplete sex linkage example, retinitis pigmentosa and Nephritis.

Thank you.