Information Leaflet

Liverpool Women's NHS Foundation Trust

X-Linked Inheritance

What are genes and chromosomes?

Genes are the unique set of instructions inside our bodies which make each of us an individual. There are many thousands of different genes, each carrying a different instruction. If a gene contains a disease-causing (pathogenic) alteration, it can cause people to have an increased chance of developing a genetic condition. A gene alteration is sometimes known as a gene variant.

We have two copies of each gene. One copy is inherited from each of our parents. When we have children, we pass on only one copy of each of our genes. Genes lie on tiny structures called chromosomes.

We have 23 pairs of chromosomes. The 23rd pair are called the sex chromosomes because they determine a person's biological sex. Typically, females have two X chromosomes and males have one X and one Y chromosome. The Y chromosome is much smaller than the X chromosome and contains fewer genes.

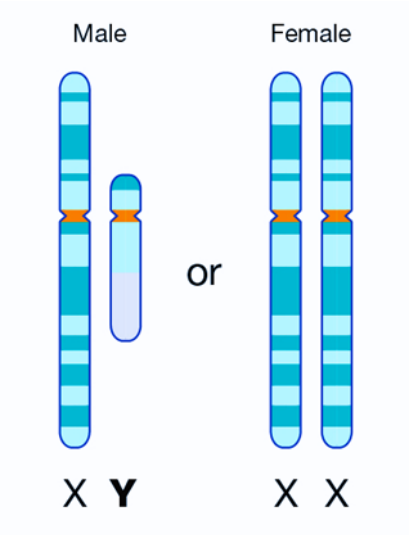

Image source: https://www.genome.gov/genetics-glossary/

What does X-linked inheritance mean?

X-linked conditions occur when a gene alteration is located on the X chromosome. X-linked conditions follow either recessive or dominant inheritance patterns.

X-linked recessive conditions

In X-linked recessive conditions, if a female has a gene alteration on one of her two X chromosomes, she will usually not be affected, but will be a ‘carrier’ of the condition. She is not affected because she has a second working copy of the gene on her other X chromosome.

Some female carriers can develop features of the condition, however, these are usually mild.

If a male has a gene alteration on his X chromosome, then he will be affected by the condition, as he has only one X chromosome, and therefore only one copy of the gene.
X-linked dominant conditions

In X-linked dominant conditions, an alteration in just one copy of a gene on the X chromosome can cause the condition. This is because the altered gene is dominant over the other copy of the gene.

Both males and females can be affected by X-linked dominant conditions. Affected males tend to have more significant condition than affected females. X-linked dominant conditions are quite rare.

Having children

When a female with a gene alteration on her X chromosome has children, there is a 50% (1 in 2) chance that she will pass on the typical copy of the gene to them. There is also a 50% (1 in 2) chance that she will pass on the altered copy of the gene (see Diagram A).

When a male with a gene alteration on his X chromosome has children, all of his daughters will inherit the altered gene. Males do not pass on their X chromosomes to their sons. Therefore, sons of men with X-linked conditions are completely unaffected (see diagram B).

X-linked inheritance (Diagram A)

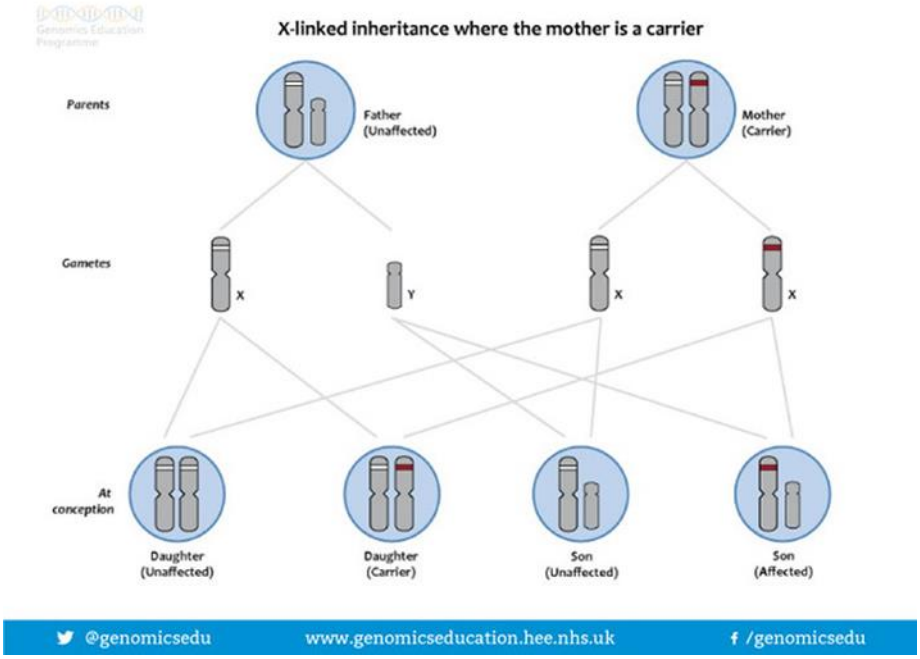

Image source: https://www.genomicseducation.hee.nhs.uk/image-library/

X-linked inheritance (Diagram B)

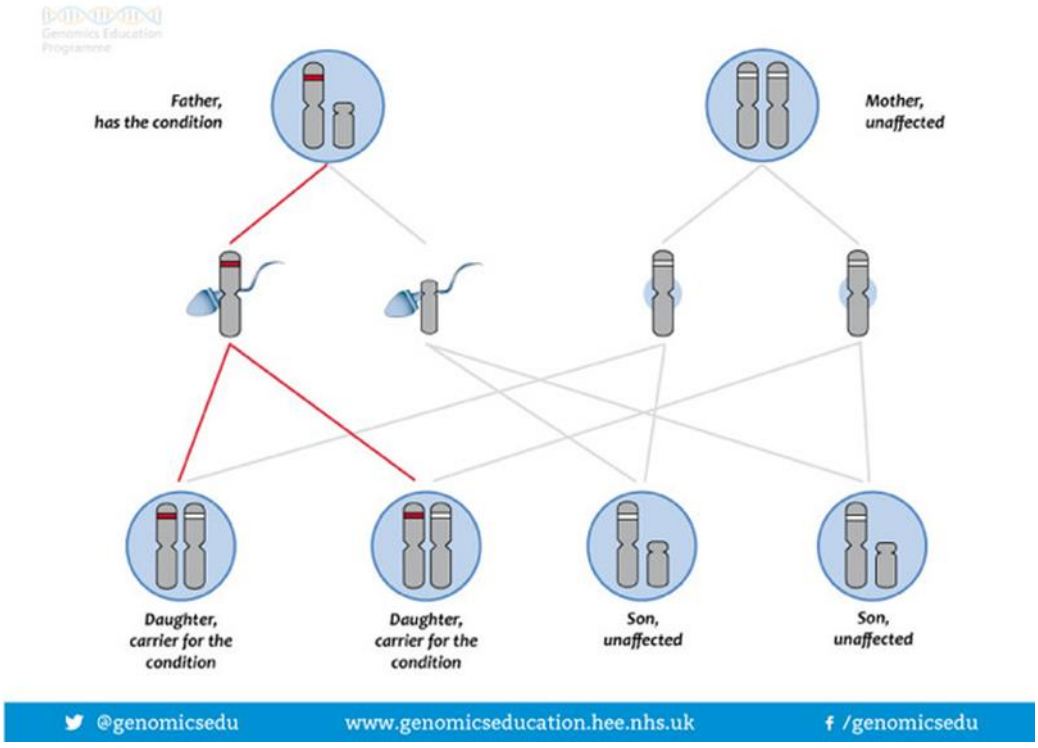

Image source: https://www.genomicseducation.hee.nhs.uk/image-library/

Note - Sometimes boys are born with X-linked conditions even though their mothers are not carriers. When this happens, it is particularly important to get specialist advice about future pregnancies.

If you need more advice about any aspect of X-linked Inheritance, you are welcome to contact:

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This leaflet can be made available in different formats on request. If you would like to make any suggestions or comments about the content of this leaflet, then please contact the Patient Experience Team on 0151 702 4353 or by email at pals@lwh.nhs.uk

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