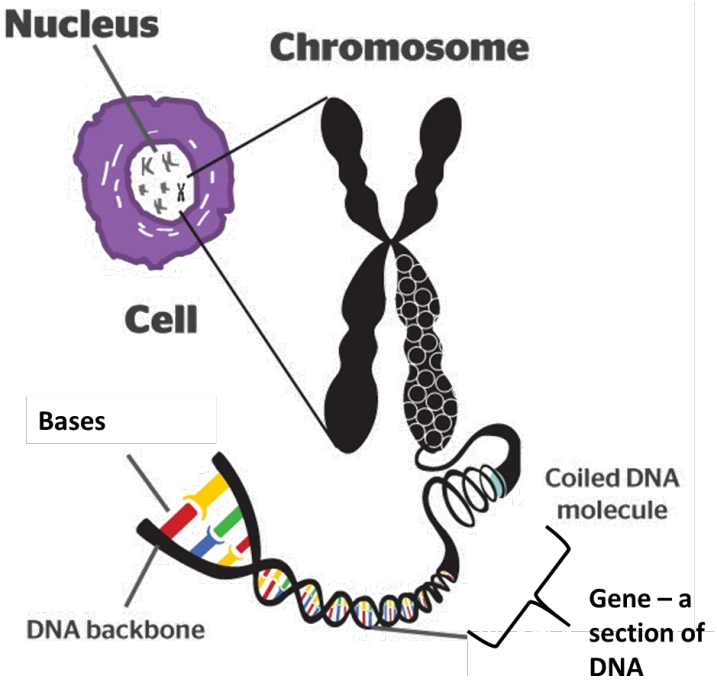
Genes are the sources of inherited information

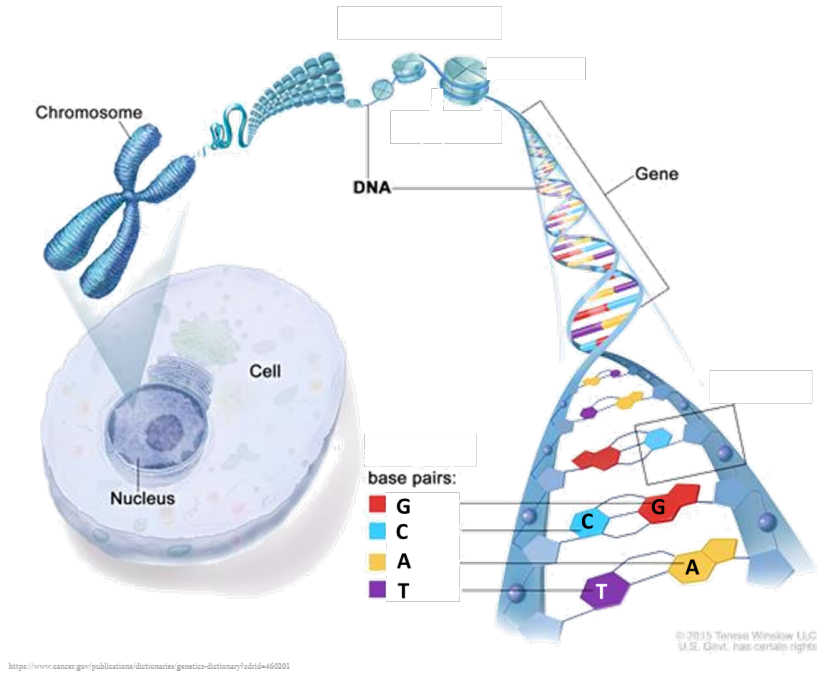
All living things are made of cells. The **nucleus** of a cell contains **chromosomes**, which carry instructions for the physical characteristics of an organism. The chromosomes are made of long strands of **DNA.** The instructions are called the **genetic code**. A segment of the DNA that codes for a specific trait is called a **gene**.



DNA forms a Double Helix shape

DNA is arranged in a **double helix** shape. The up rights of the "ladder" consist of alternating sugar and phosphate molecules bonded together. Making up the "rungs" are **two base molecules** bonded to each other.

A nucleotide is one unit of DNA. DNA (deoxyribonucleic acid) is made from smaller repeating units called nucleotides, which consist of a sugar, a triphosphate and a base.



There are 4 bases

A, T, C, G

Complementary base-pairing rule

G bonds with C

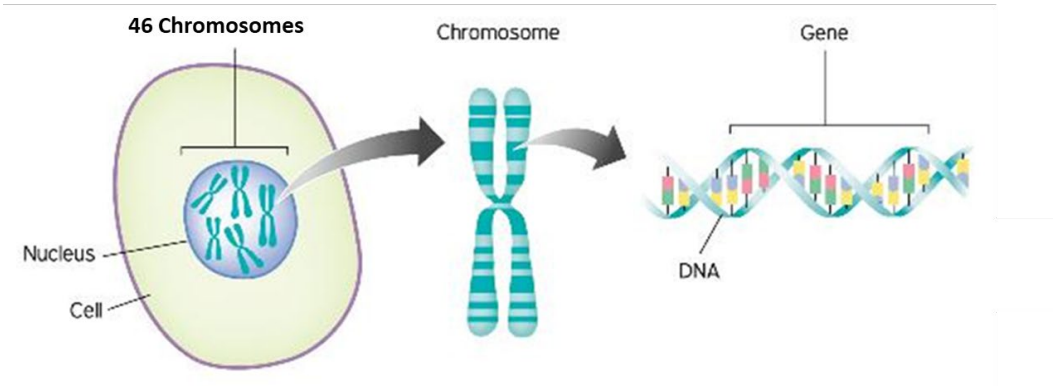
A bonds with T

The order of these bases is the **code** for a **characteristic**.

The sequence of bases coding for a specific protein, leading onto a trait, is called a gene.

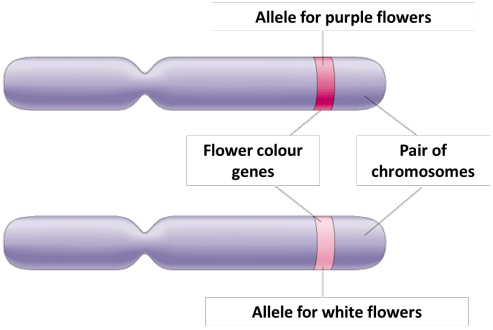
DNA is organised into chromosomes and genes

The human cell has **46 chromosomes** arranged into 23 pairs of chromosomes. Each chromosome in a pair has the same genes, (called **homologous** pairs) although there may be variation between the genes of each pair, as one comes from the father and one comes from the mother. Each gene is represented by two **alleles**, which are different varieties. The alleles can be the same or different, but the body only uses one.



Alleles are different forms of the same gene

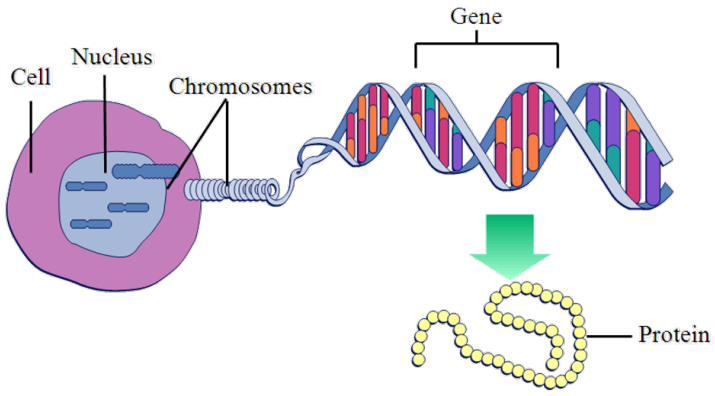
Chromosomes occur in **pairs**. These pairs of chromosomes have the same genes in them at the same place. The versions of genes are called **alleles** and they may be different from each other.



Summary: Cell, nucleus, chromosome, DNA, gene and protein

Chromosomes are found in the **nucleus** of each **cell** and are made up of **DNA**. DNA is a large molecule that is coiled into a double helix (twisted ladder structure). Along this molecule are **bases**. These bases pair up; A always pairs with T, and G with C.

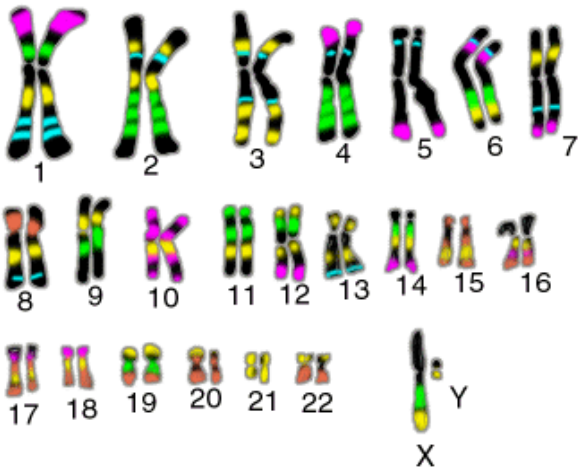
A sequence of bases, which codes for a particular **trait/characteristic** (e.g., eye colour) is called a **gene**. The different versions of each gene are called **alleles**, and these show the different **variations** of each characteristic, e.g. brown / blue eyes. Because chromosomes come in pairs for each trait, there will be two possible alleles. These different versions of genes (alleles) occur because the DNA base sequence is different.



Extension

Genes code for **proteins** - the **genetic code/ base order** determines which particular **protein** is made and therefore which **characteristic** is coded for.

Chromosomes come in pairs



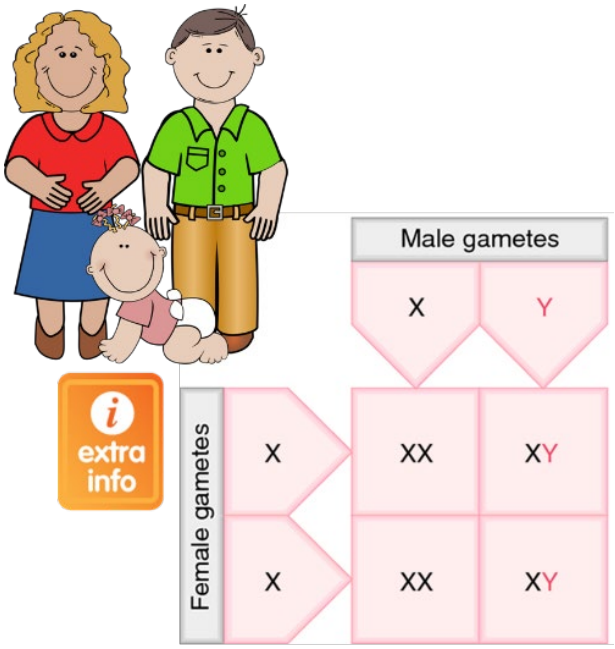
Chromosomes come in pairs. One pair is the sex chromosomes – XX in females and XY in males. A complete set of chromosomes of an organism placed into pairs of matching chromosomes is called a **karyotype**. The human karyotype consists of **23 pairs** of chromosomes.

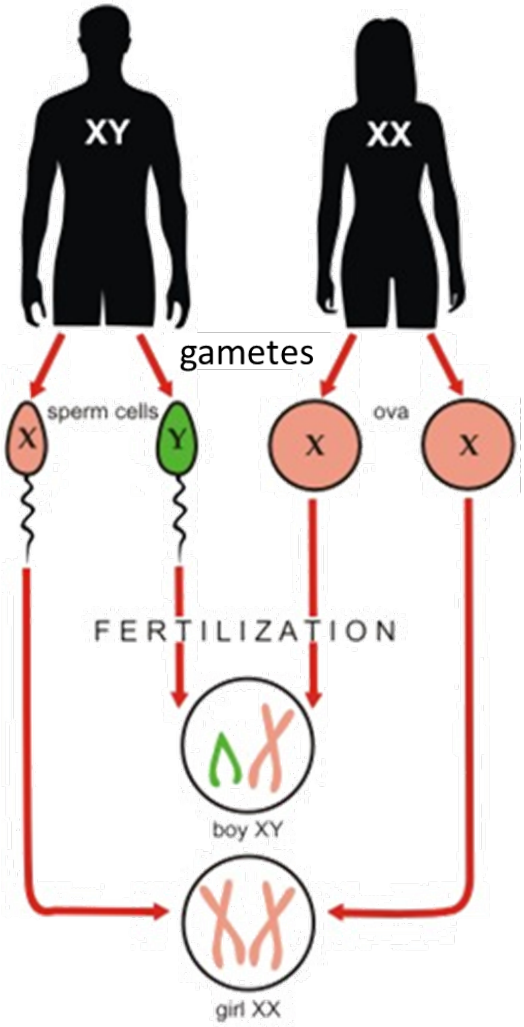
Sex determination

A pair of chromosomes are called the **sex chromosomes**. The female always has a homologous pair of two x chromosomes. The female can only donate a x chromosome. The male has a x and y chromosome. He can donate either an x or y chromosome to form a gamete. **The male determines the sex of any children.**

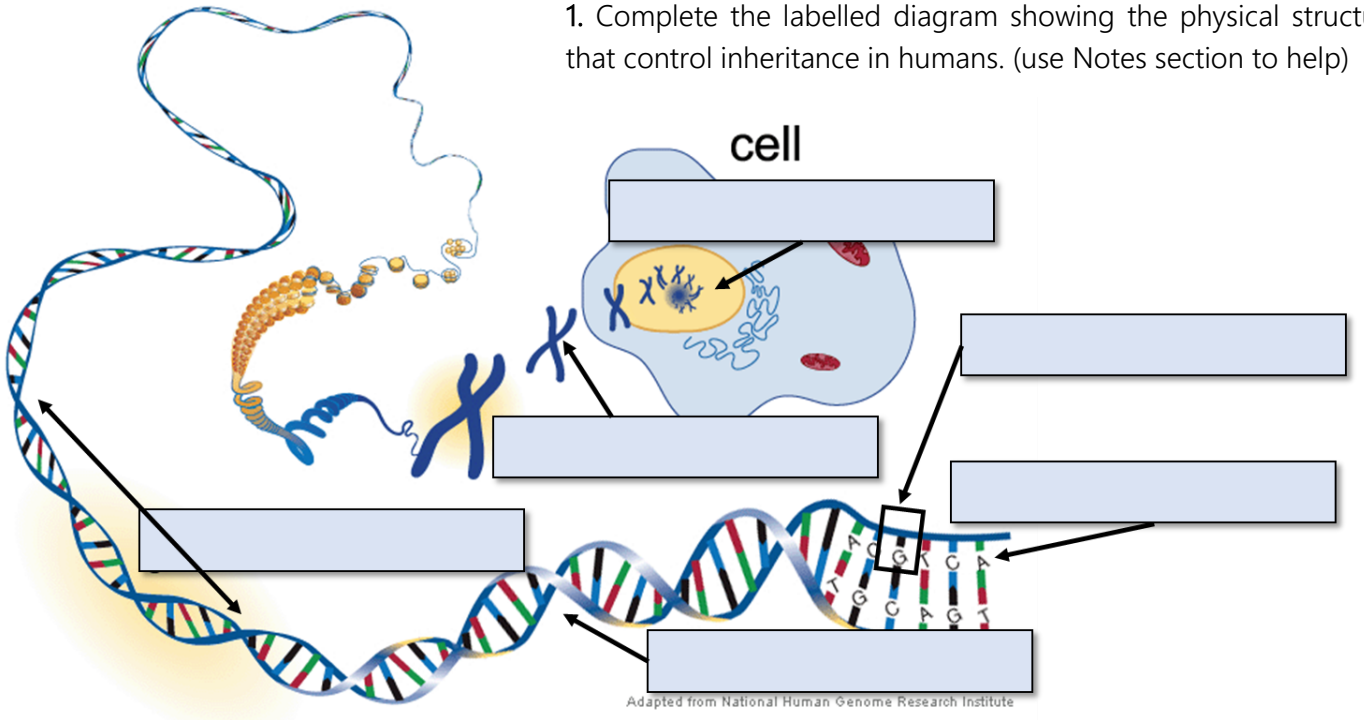
A Punnett square can be used to demonstrate that in any fertilisation there will be a 50% chance of either a boy or a girl.

If there are a small number of offspring, then there is less chance that the actual ratio of male to female offspring will be the same as the predicted ratio. Each new fertilisation is independent of any previous fertilisation episodes.

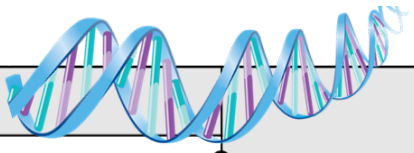




1. Complete the labelled diagram showing the physical structures that control inheritance in humans. (use Notes section to help)

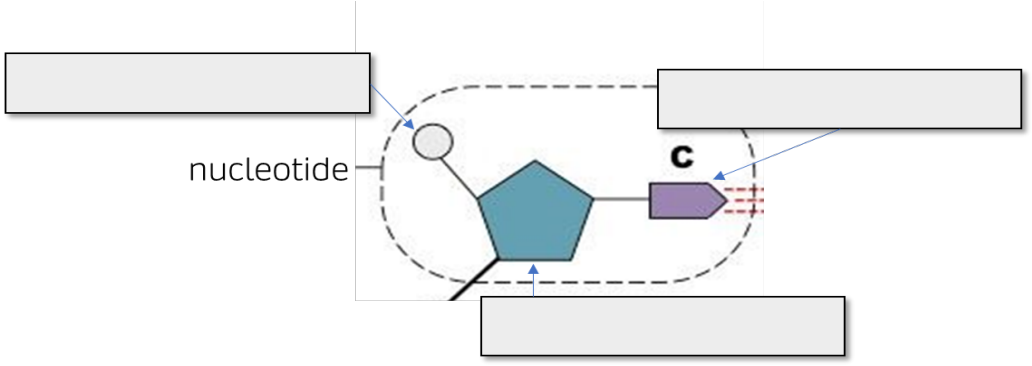


2. Place the names of the physical structures from above in **order of size** from smallest to largest, then **draw a line** to match definitions

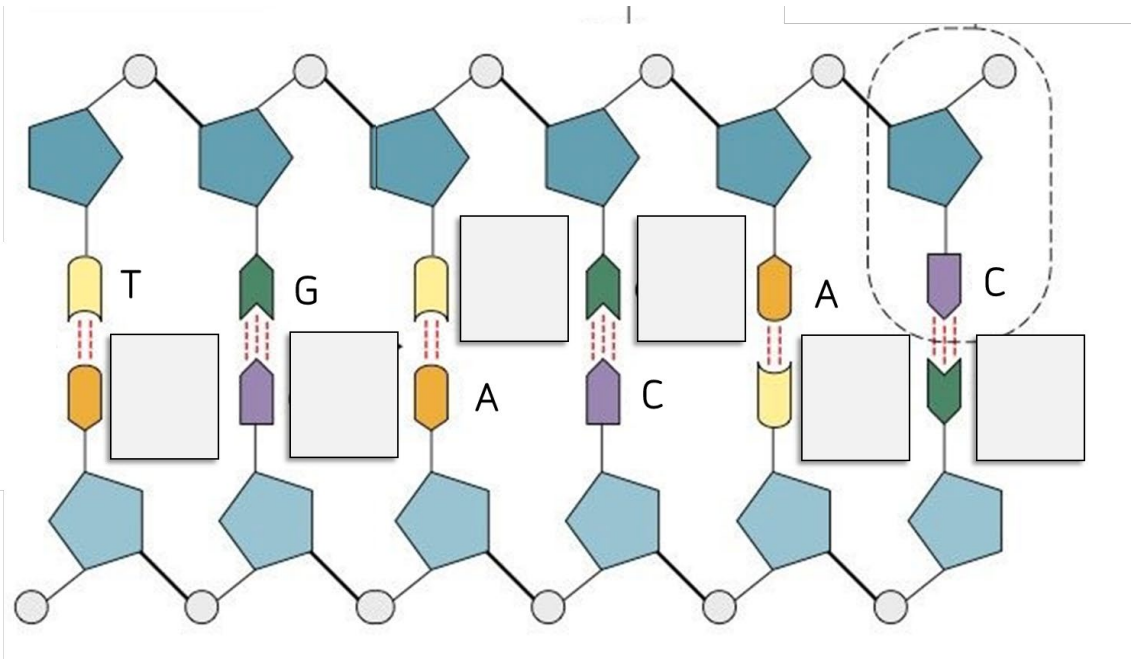


Term	Definition
smallest	Organelles inside a cell and containing all the genetic material
	A segment of the DNA that codes for a specific trait
	Structures, of which there are 46 in each human body cell
	Small repeating units, which consist of a sugar, a triphosphate and a base.
	these come in four different types, pairing together
	Arranged in a **double helix** shape.

3. Label the nucleotide unit with the names of the three components



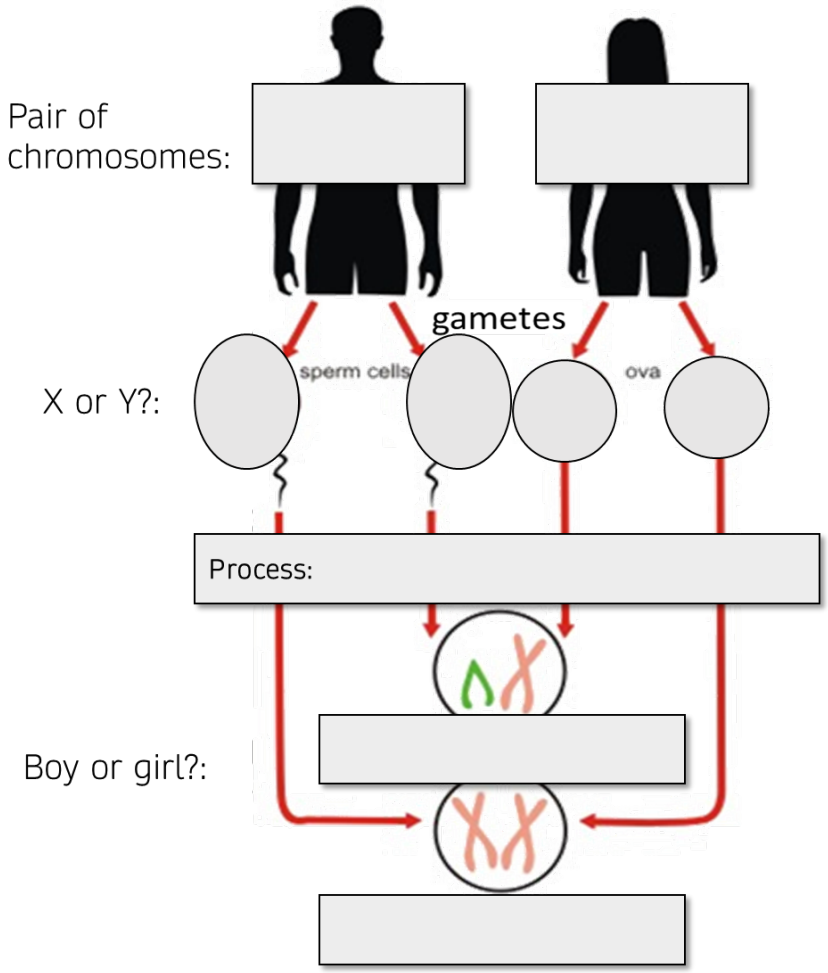
4. Complete the base sequence in this DNA strand



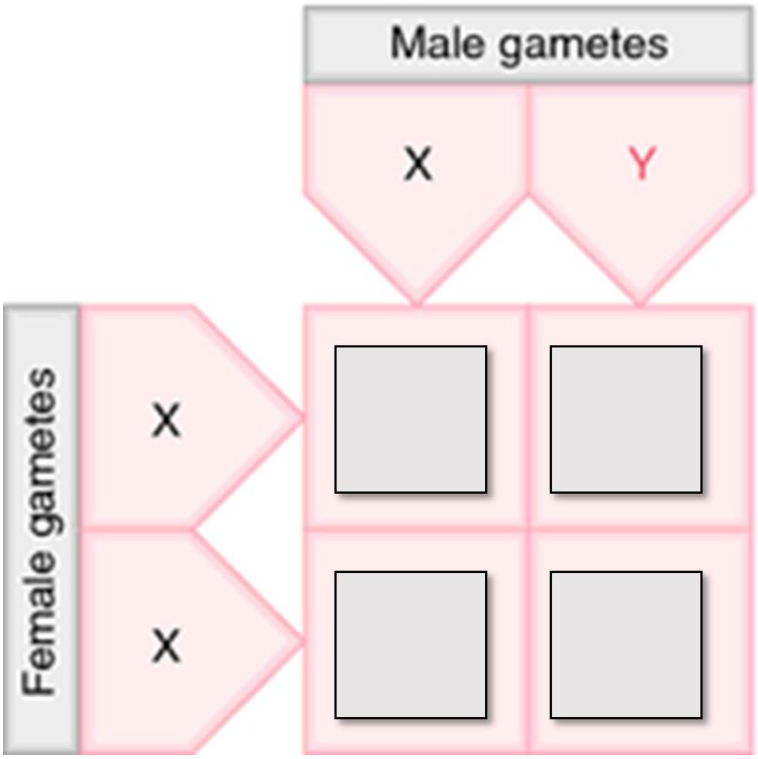
5. Use the writing grid to help develop a discussion level answer in your own words for the link between DNA, genes, chromosomes, and alleles. (see notes above for help)

1. explain link between chromosomes and DNA	
2. describe the physical structure of DNA	
3. **Explain the pairing rule of DNA**	
4. link the **base sequence to trait and gene (use example)**	
5. Give the definition for an allele (use example)	
6. link pair of chromosomes to pair of alleles	
7. link alleles to base sequence	

6. Complete the labelled diagram showing sex determination in humans.



7. Complete the Punnett square to show what chances there are of having a boys or girl



What are the chances of having a girl?

_____ %

What are the chances of having a boy?

_____ %

What are the chances of a family having a boy, after having three girls – and explain why.

_____

_____

_____

_____

_____