

Objective : understand that organisms inherit characteristics from their parents through genetic material that is carried in cell nuclei

Resources : Student book

Video

<https://www.youtube.com/watch?v=v8tJGlicgp8> introduction

<https://www.youtube.com/watch?v=mcEV3m9SG9M&t=132s> genes and chromosomes

<https://www.liveworksheets.com/yb1661878de> live worksheet

NO need to memorize the structure of the DNA

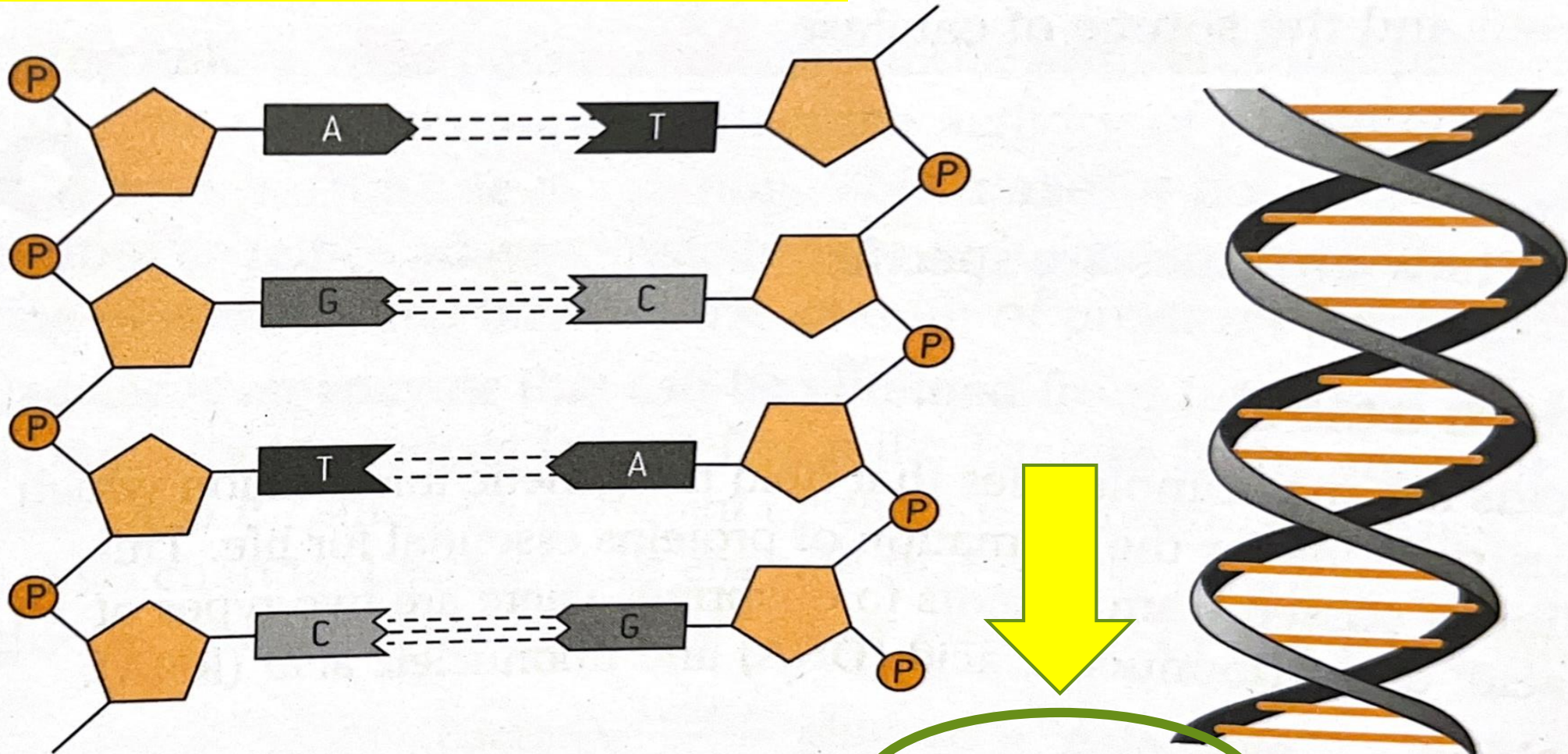
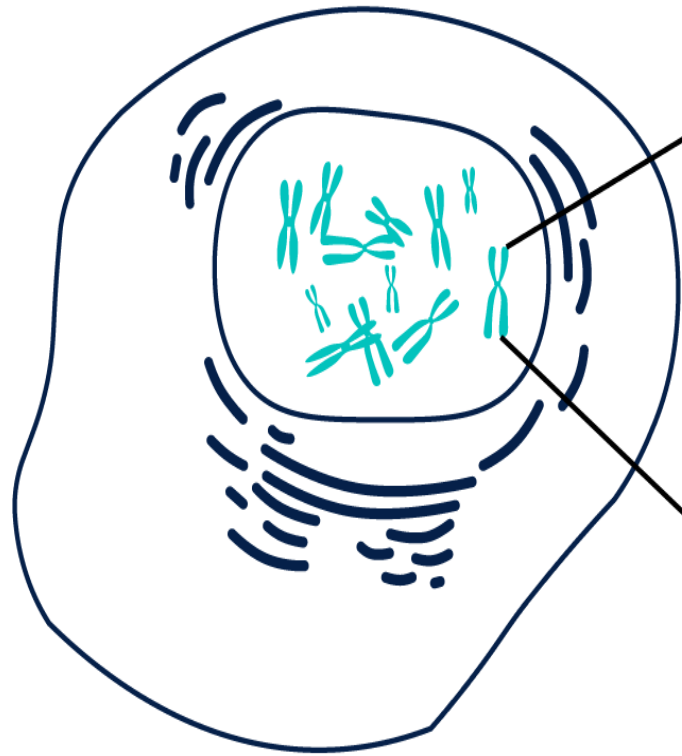
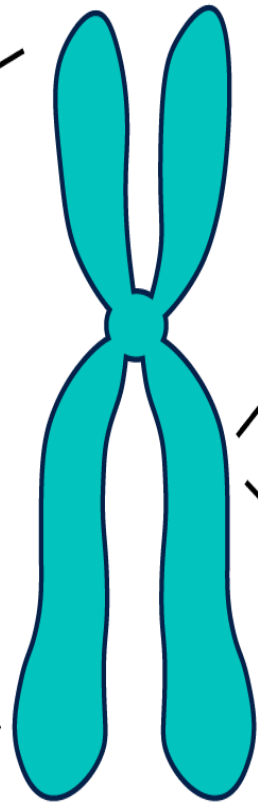


Figure 21. Left: Structure of DNA; right: DNA double helix



Cell



Chromosome



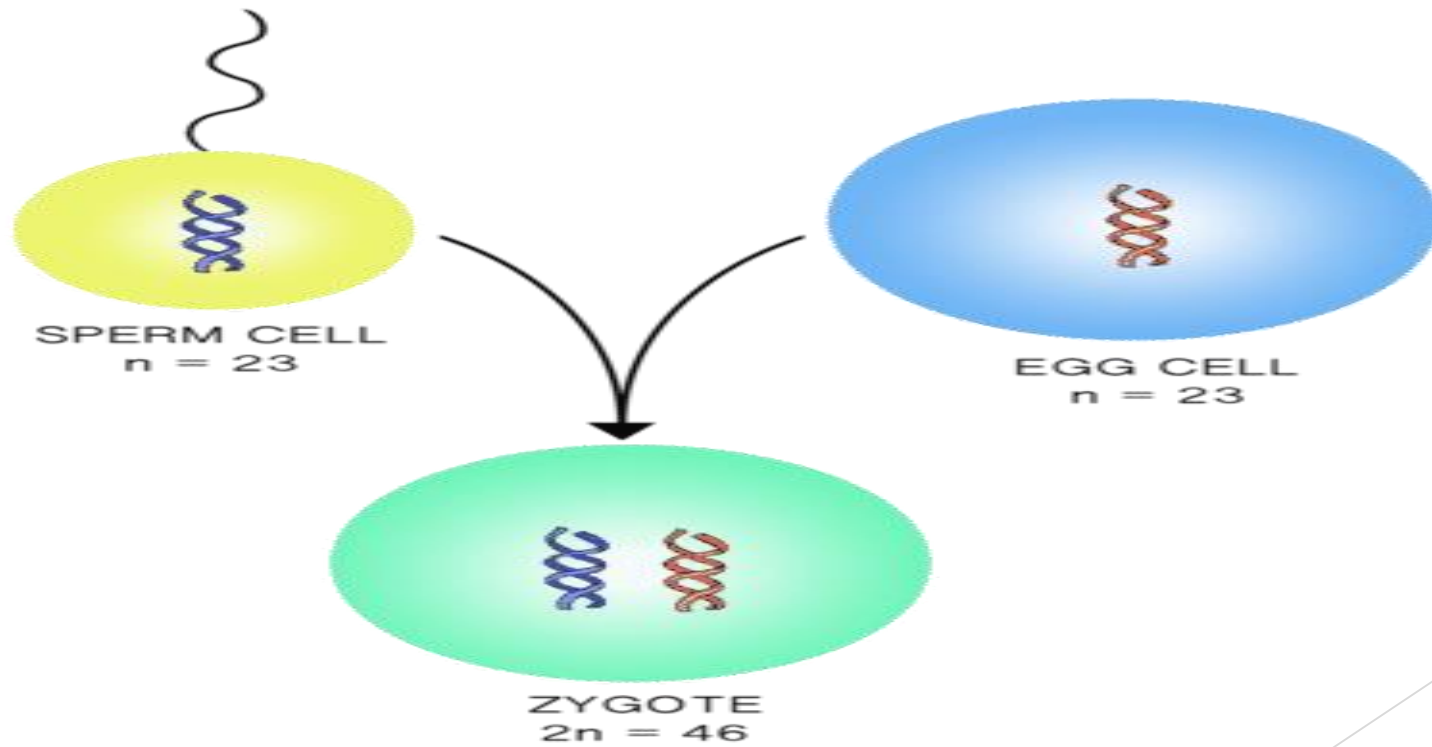
DNA

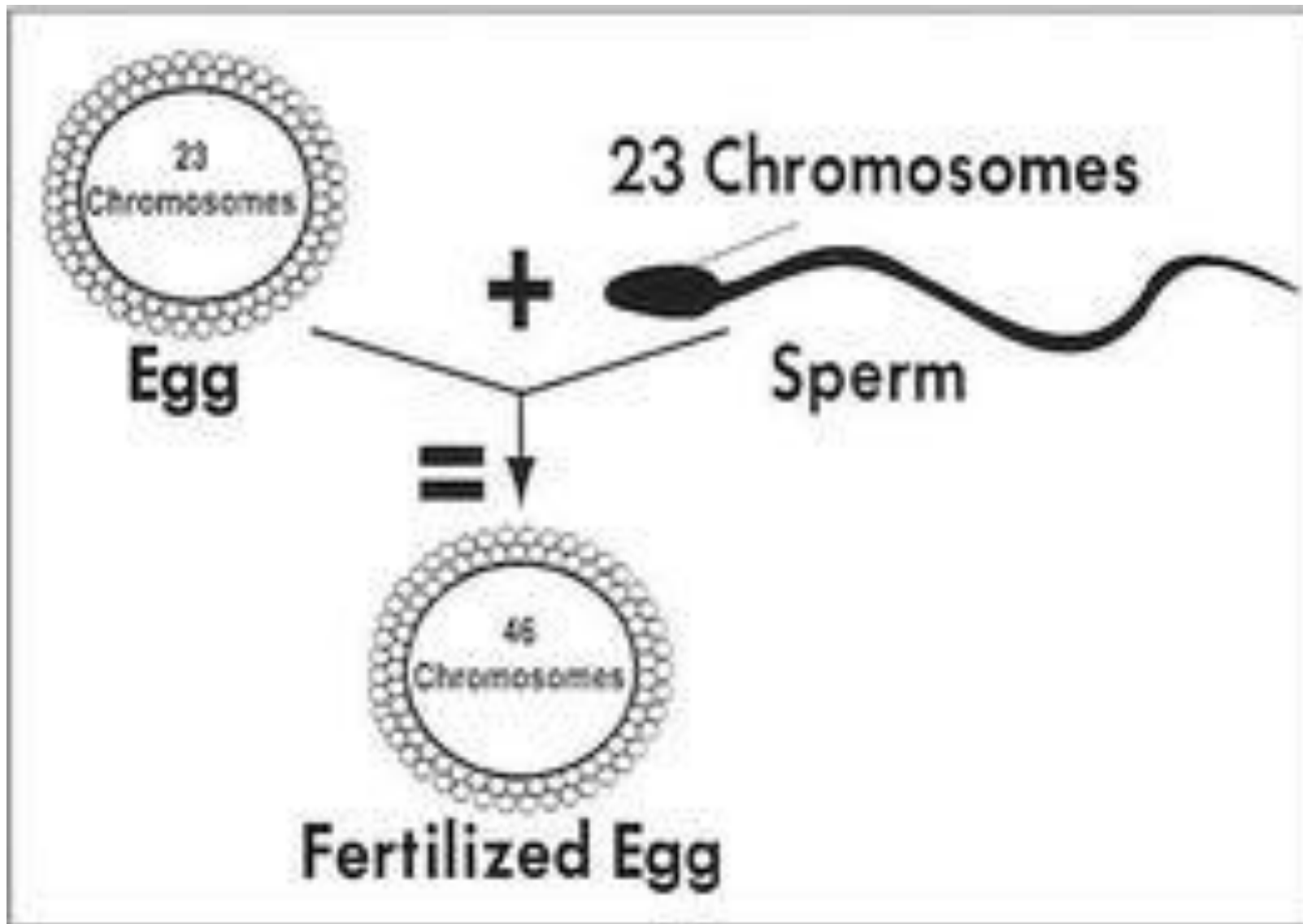


Gene

Boys & girls

The usual number of chromosomes inside every cell of your body is 46 total chromosomes arranged in pairs of 23 . You inherit half of your chromosomes from your mother, and the other half from your father.

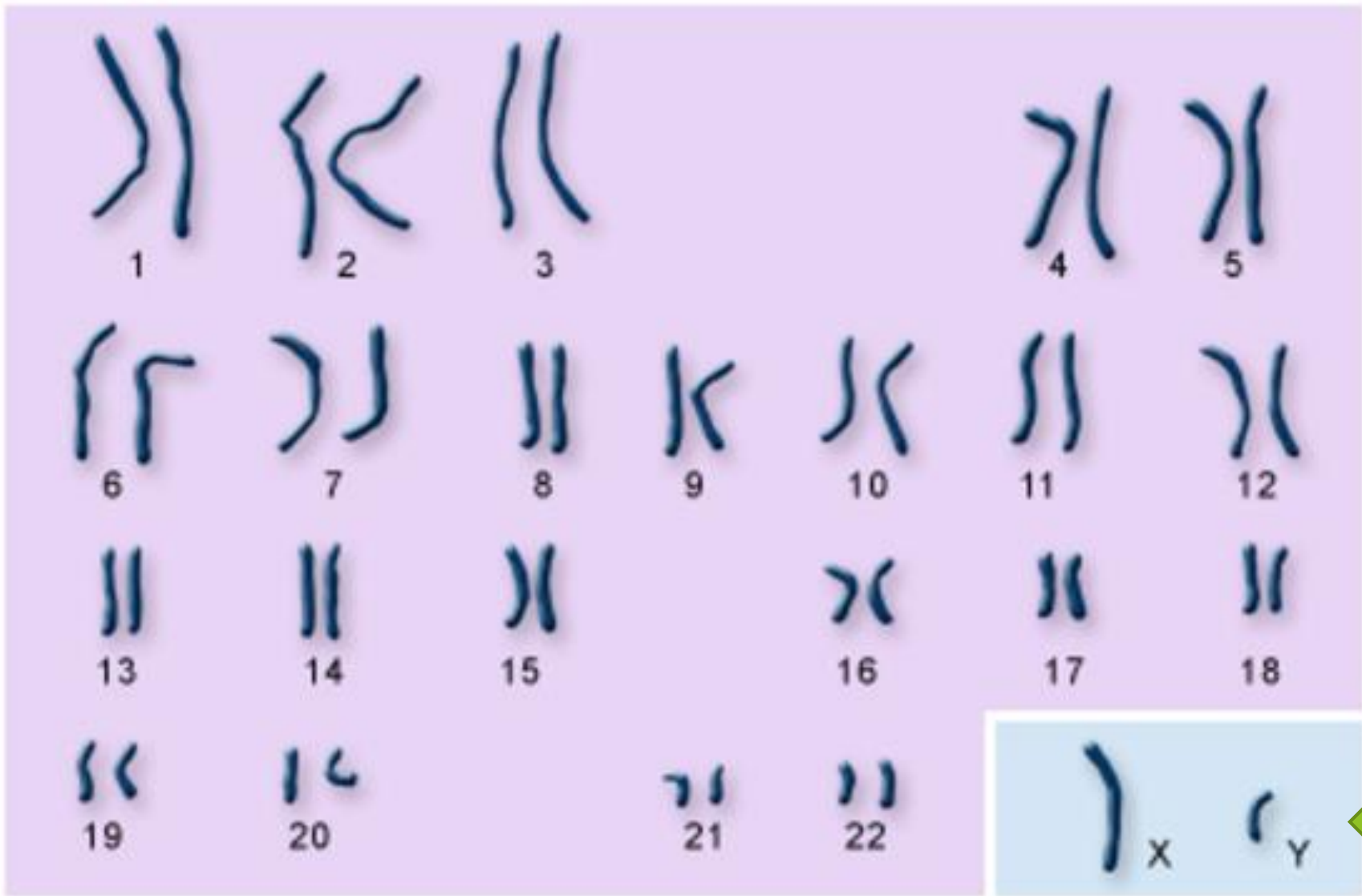




Scientists have numbered the chromosome pairs from 1 to 22, with the 23rd pair labeled as X or Y. The first 22 pairs of chromosomes are called autosomes because they look the same in both males and females, the 23rd pair of chromosomes is known as the sex chromosomes, because they decide if you will be born male or female.

Females have two X chromosomes, while males have one X and one Y chromosome.





autosomes

sex chromosomes

boy



Genes

Recognise that genes are parts of chromosomes. Understand that we inherit two copies of each chromosome, one from each parent.

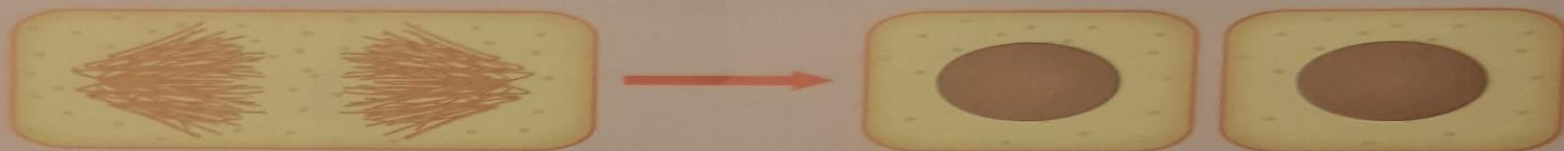
Inside cells

Cell nuclei usually look like a dark circle under the microscope, but special stains make them show up more clearly.

When a cell is ready to divide, long thin threads appear in its nucleus. They split into two identical sets and move to opposite ends of the cell. Each set forms a new cell nucleus as the original cell divides.



The cells in this light microscope image have been stained to make their nuclei show up more clearly.



threads pulled to opposite ends of the cell

new nuclei form and the cell divides

A dividing cell copies everything in its nucleus before it splits into two new cells.

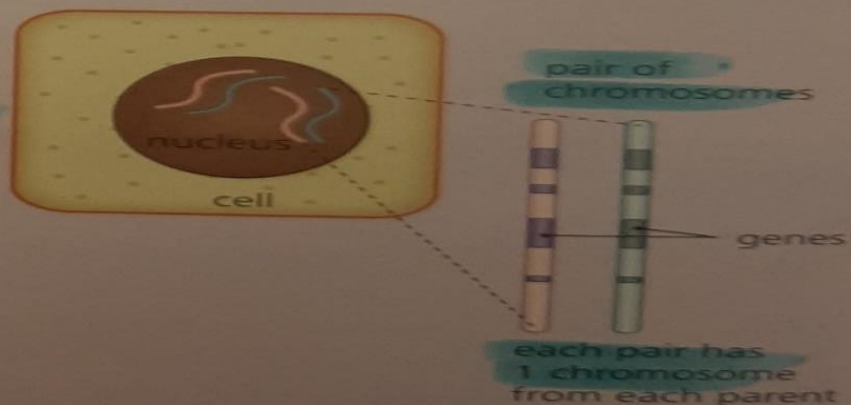
Genes and chromosomes

The long thin threads in cell nuclei are called **chromosomes**. They are made from a giant molecule called **DNA**. Scattered along each chromosome are special sections of DNA called **genes**.

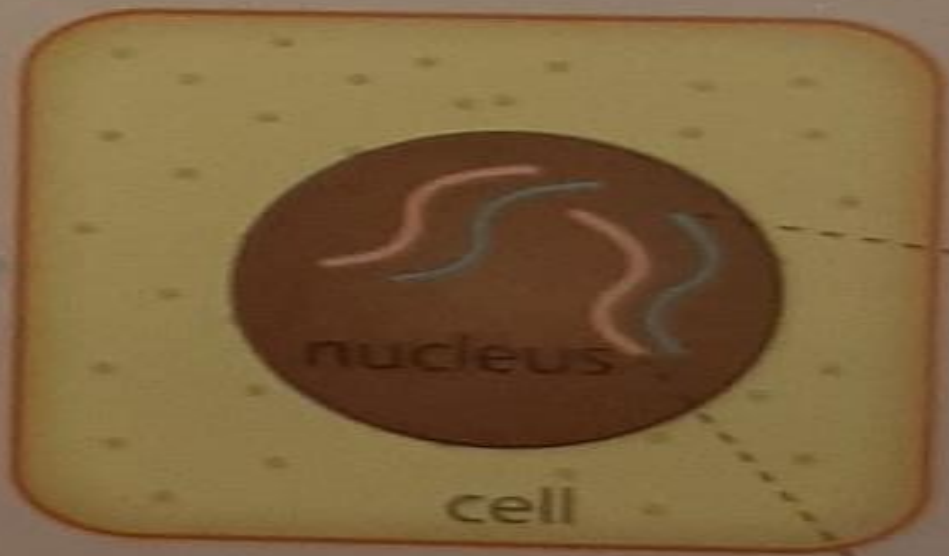
Once a cell has finished dividing the chromosomes are hidden inside the nucleus. The nucleus in the diagram has two pairs of chromosomes, but real human cells have 23 pairs. We inherit 23 chromosomes from each parent – one chromosome in each pair comes from each parent. So we inherit half of each parent's genes.

The chromosomes in the diagram each contain four different genes, but real human chromosomes contain up to 1000 genes.

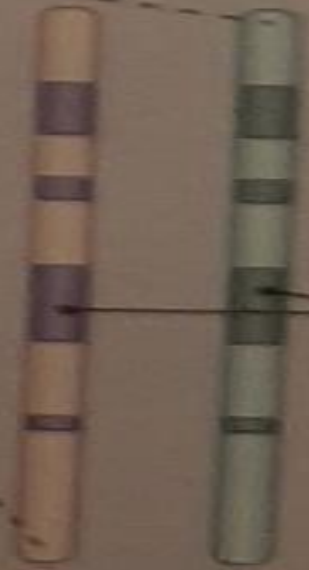
The genes on paired chromosomes do the same jobs as each other, so we inherit two copies of each gene – one from each parent.



Genes are found on chromosomes in the nucleus of every cell.



pair of chromosomes



genes

each pair has 1 chromosome from each parent

↑ Genes are found on chromosomes in the nucleus of every cell.

Sex chromosomes

One pair of human chromosomes comes in two forms called X and Y. These chromosomes carry the genes that decide whether you are male or female. Females have two X chromosomes and males have an X chromosome and a Y chromosome.

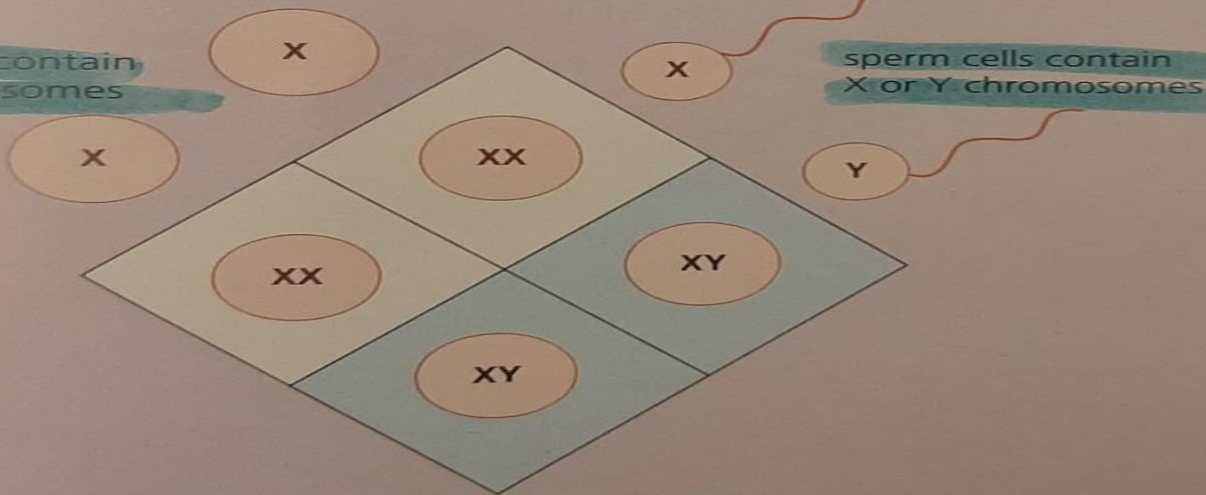
Boy or girl?

Each human egg or sperm cell contains 23 chromosomes – one from each pair.

Egg cells always contain X chromosomes but males can make two sorts of sex cells. On average, half a man's sperm carry X chromosomes and half carry Y chromosomes.

Sperm containing X or Y chromosomes have an equal chance of fertilising egg cells. So a fertilised egg cell could get two X chromosomes and produce a girl, or get an X and a Y chromosome and produce a boy. The diagram shows that the chances of producing a boy are 2 in 4, which is the same as 1 in 2 or 50%.

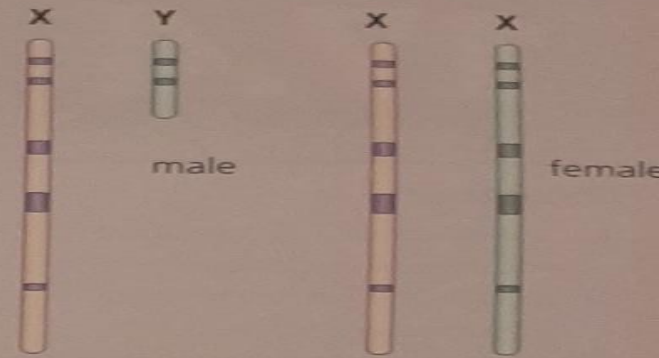
egg cells contain X chromosomes



pairs of eggs and sperm can combine in four possible ways

On average, equal numbers of fertilised eggs produce males (XY) and females (XX).

Variation and classification



One pair of chromosomes is different in males and females.

- Genes are parts of chromosomes and are made of DNA.
- The nucleus of a human cell contains 23 pairs of chromosomes.
- One of the chromosomes in each pair was inherited from

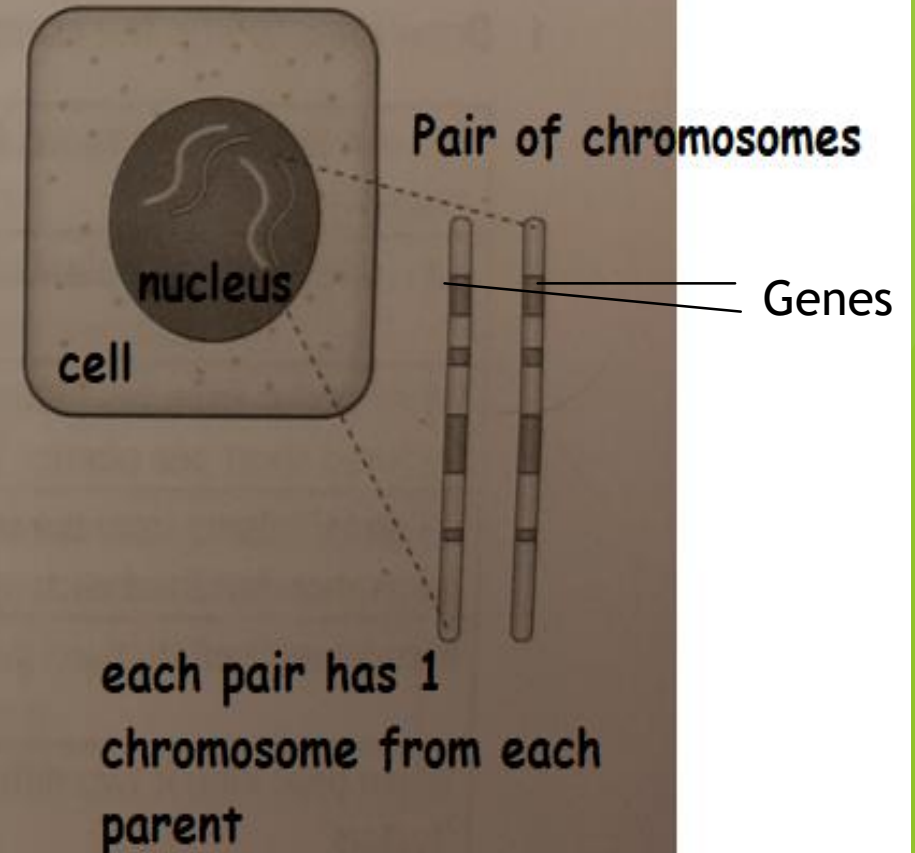
Workbook page 91 / Question 1

Extension: Variation and classification

17.3 Chromosomes

- 1 This diagram shows a human cell.
- a Add labels to the diagram to show where the genes are stored in a cell.
- b Describe two differences between the diagram and a real cell.
The nucleus in the diagram has two pairs of chromosomes, but real human cells have 23 pairs.
The chromosomes in the diagram contain four different genes, but real human chromosomes contain up to 1000 genes.
- c How can you tell whether a cell is from a boy or a girl?
Females have two X chromosomes but males have an X chromosome and a Y chromosome.

Chromosome number 23 - the sex chromosomes



Workbook page 91 / Question 2

2 Decide whether these sentences are true for 'genes', 'chromosomes' or 'both'.

a Found in the nucleus

Both
.....

b Inherited from our parents

Both
.....

c Visible just before a cell divides

CHROMOSOMES
.....

d Made from giant molecules called DNA

CHROMOSOMES
.....

e Made from special sections of DNA

Genes
.....

f There are thousands in each cell

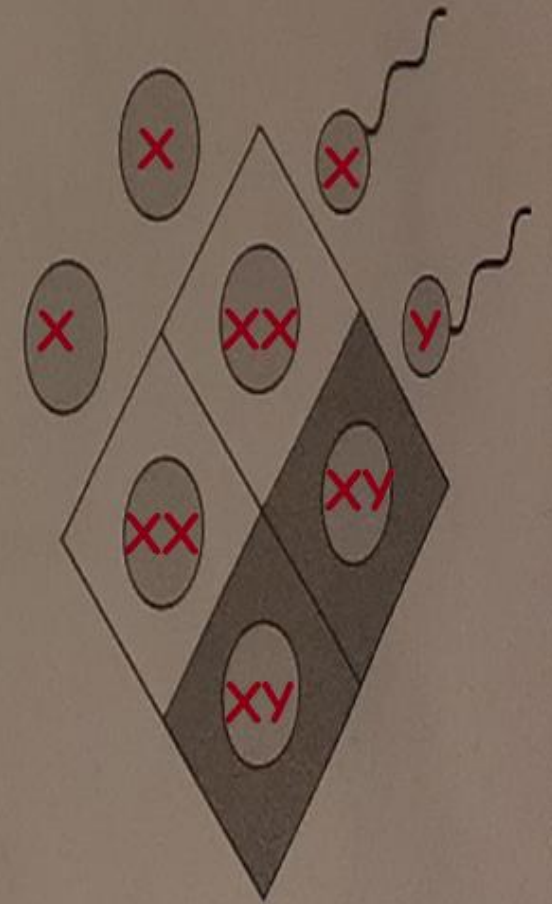
Genes
.....

g There are 23 pairs in each cell

chromosomes...
.....

Workbook page 91 / Question 3

3 Label the diagram on the right to show why fertilised eggs are equally likely to be male or female.



Workbook page 91 / Question 4

4 The diagram shows the chromosomes from a child with Down's syndrome. Children born with Down's syndrome have a range of physical features. These include wide, flat faces and a short neck. They grow more slowly than normal and tend to be short as adults.

a Is this child a boy or a girl?

... **A BOY**

b What is unusual about the child's chromosomes?

... **He has three copies of chromosome 21 instead of two**

c Older mothers are more likely to have children with Down's syndrome. Suggest how the child got this combination of chromosomes.

... **caused by abnormal cell division during the development of the egg cell Or the sperm cell**

