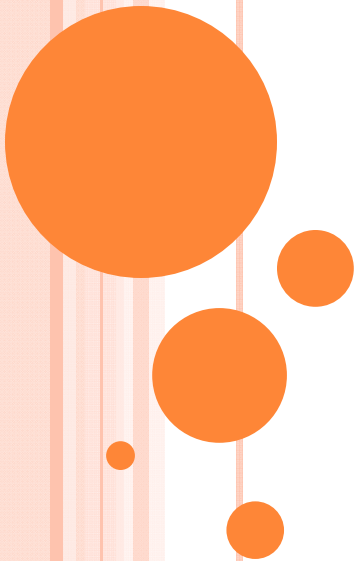


CROSSING OVER



DEFENITION

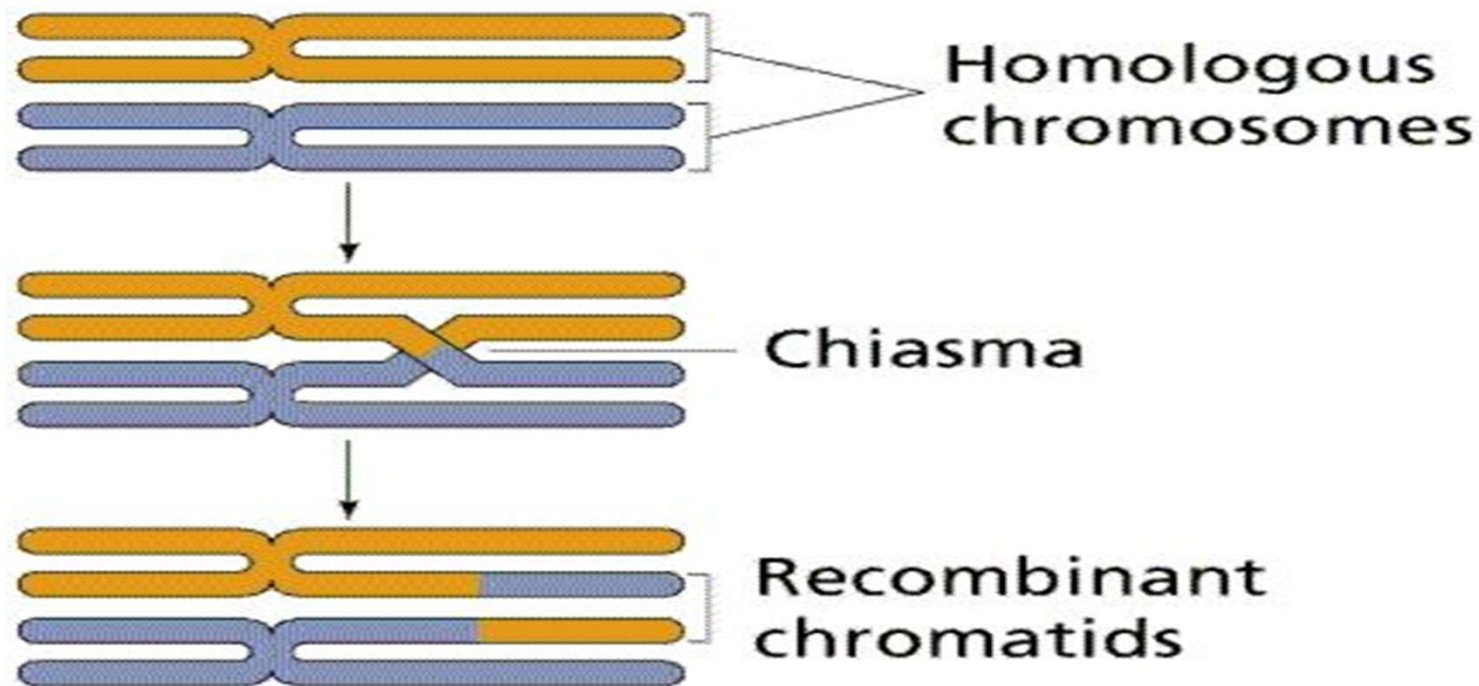
Crossing over is the process of exchange of genetic material or segment between non sister chromatids of two homologous chromosomes.



TYPES OF CROSSING OVER

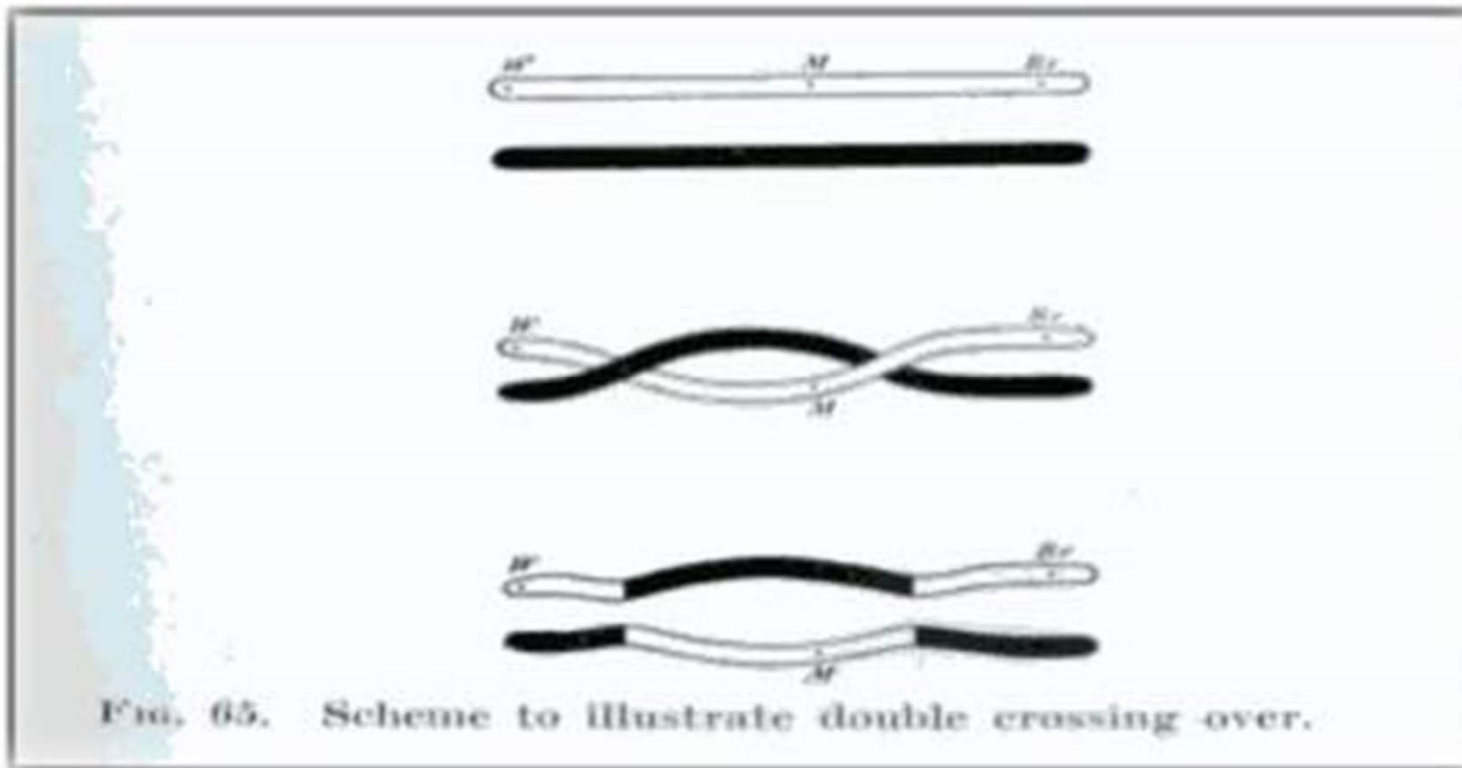
1. SINGLE CROSSING OVER

Only one chiasma is formed all along the length of a chromosome pair .



2. DOUBLE CROSSING OVER

Two chiasma are formed along the entire of the chromosome leading to breakage and rejoin of chromatids at two points.



3. **MULTIPLE CROSSING OVER**

More than two chiasma are formed and thus crossing over occurs at more than two points on the same chromosome pair.



THEORIES OF CROSSING OVER

PARTIAL CHIASMA TYPE THEORY

According to this theory breaks occur only in two chromatids out of the 4 at the pachytene stage.

These 4 again rejoined and the chiasma are formed i.e. chiasma is the result of crossing over.



COPY CHOICE THEORY

The paired chromosomes duplicate their genes before the fibres join them to form strands.

When the chromosomes are twisted around each other reciprocal exchange of the chromatids takes place .



- There may be some recombination during the period of DNA synthesis affecting short unpaired segment of the chromosomes.
- A small part of new DNA helix being synthesized may copy a non-sister helix rather than a sister helix to produce recombination in a very short period.



MECHANISM OF CROSSING OVER

SYNAPSIS

The homologous chromosome pair length wise due to a force of mutual attraction in zygote of prophase1 in meiosis.

The pairing at one or more points and proceed along the whole length in a zipper fashion.

The process of pairing is called synapsis.

The paired homologous chromosomes are called bivalents.



DUPLICATION OF CHROMOSOMES

- Synapsis is followed by the duplication of chromosomes which changes the bivalent nature of chromosomes to 4 strands stage or tetravalent.
- 4 stranded stage of chromatids occurs due to splitting of homologous chromosomes into sister chromatids attached with unsplitted centromeres.



CROSSING OVER

In pachytene stage crossing over occur.

The crossing over can take place at several points
The number of chiasmata formed is proportional to
the length of chromatids.

The gene at distant loci undergo crossing over but
closely placed gene fail to cross over and exhibit
the phenomenon of linkage.



TERMINALIZATION

During diakinesis, chiasmata move towards the end of bivalent by a process called terminalization.

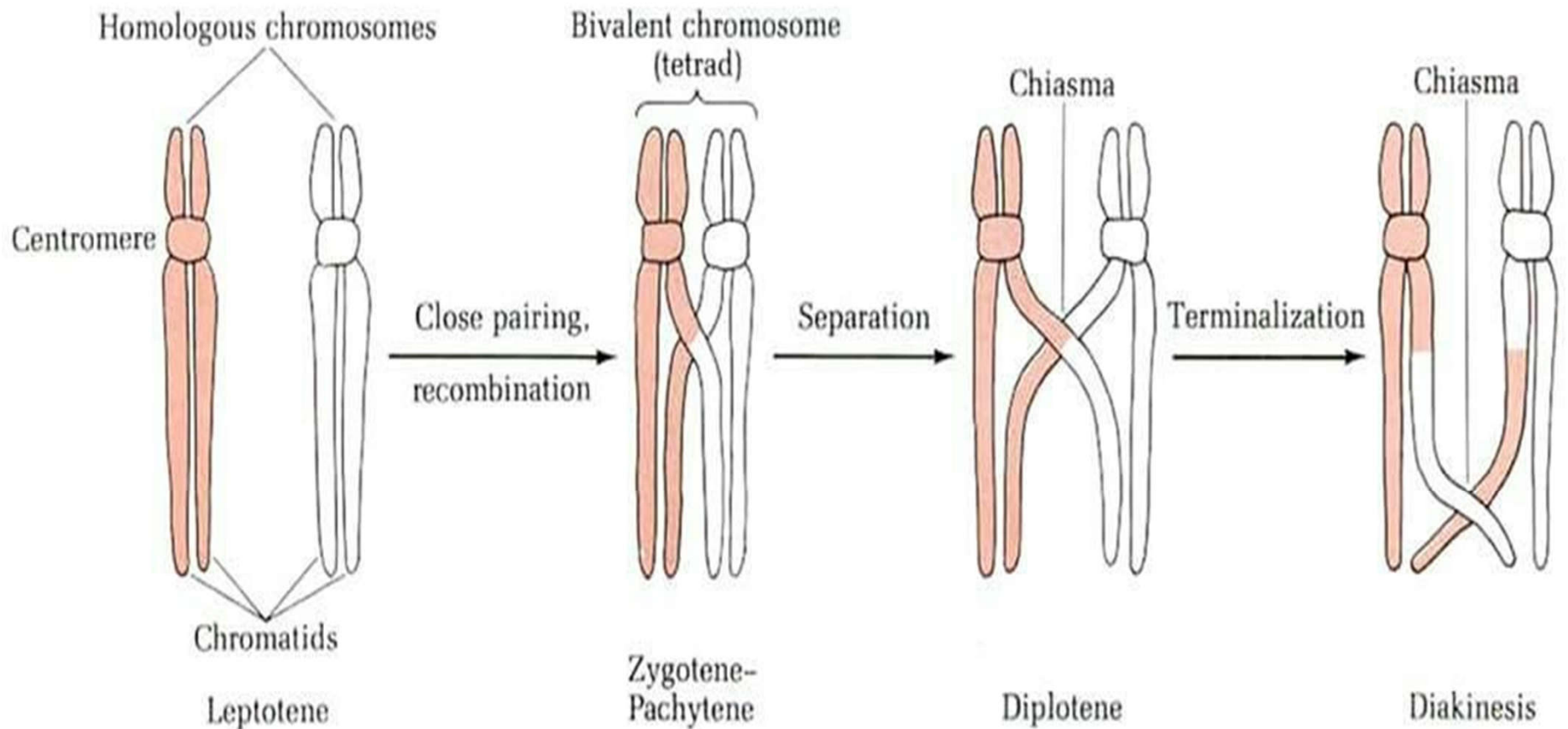
Thus twisting chromatids separate

So that the homologous chromosomes are separated completely.

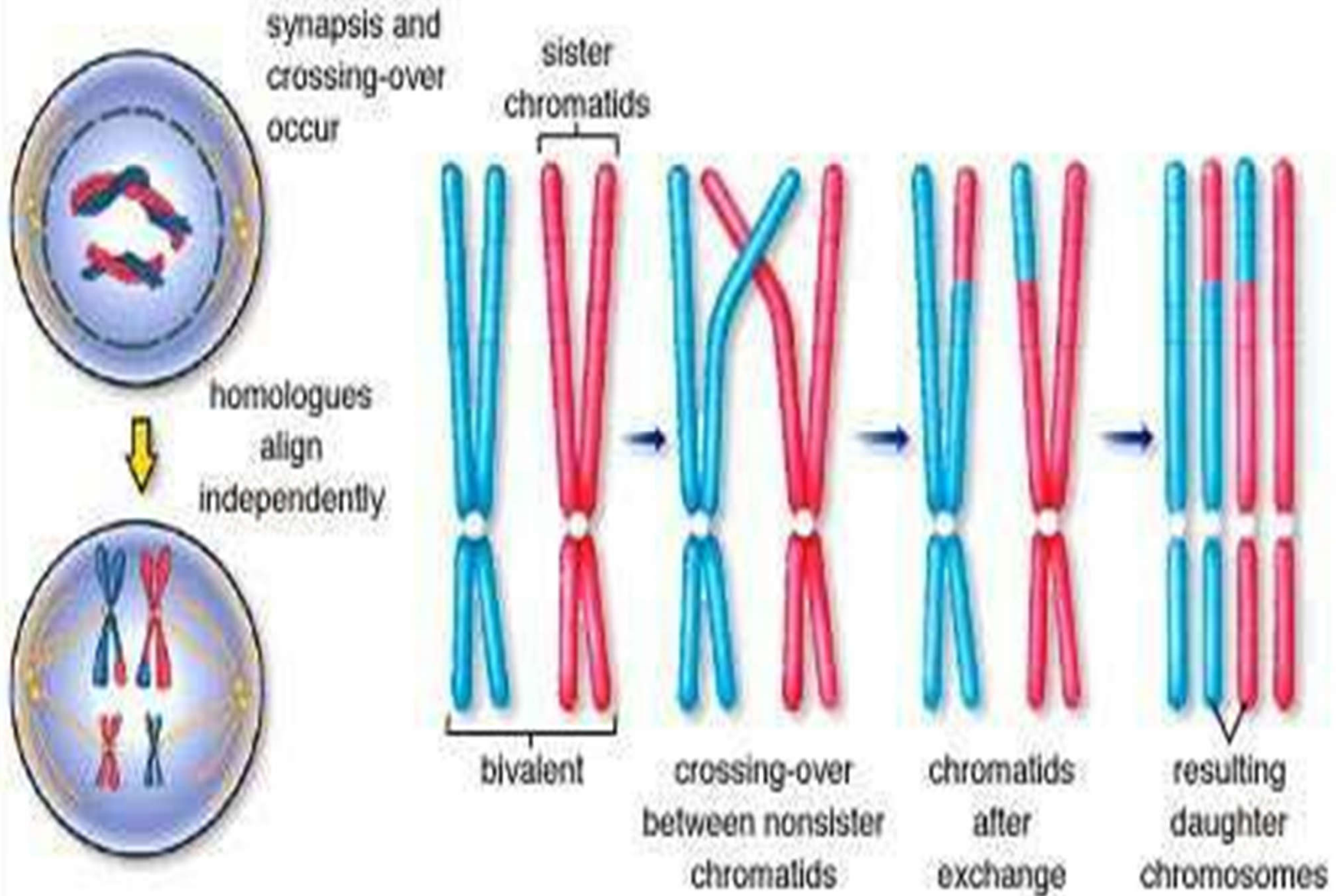
At anaphase homologous chromosomes separate .



At the end of meiosis 4 types of gametes are formed.
2 will be of parent type and
2 will contain chromosomes with recombination of genes
formed during crossing over.



Meiosis - Prophase I



FACTORS INFLUENCING CROSSING OVER

- SEX:- crossing over is completely suppressed in male but high in female.
- MUTATION:- reduces crossing over in all the chromosome of drosophilla.
- INVERSION:- inversion is an intersegment change in the chromosome. In a given segment of chromosome crossing over is suppressed due to inversion.



TEMPERATURE:- high and low temp. variates the percentage of crossing over in certain part of the chromosome.

X-RAY:- irradiations increase crossing over near centromere.

AGE:- when the female become older the rate of crossing over increases.

NUTRITION:- high calcium diet in young drosophilla decreases crossing over rate where as diet deficient of metallic ions increases crossing over.



SIGNIFICANCE OF CROSSING OVER

1. Crossing over provide direct proof for the linear arrangement of genes.
2. Through crossing over segment of homologous chromosomes are interchanged and provide new characters and genetic variations.
3. Crossing over has led to the construction of linkage map or genetic maps of chromosomes.



4. Linkage group and linear order of the genes help to reveal the mechanism and nature of the genes.
5. Crossing over plays very important role in the field of breeding to improve the varieties of plants and animals.



**THANK
YOU**

