

Cell Division

Prokaryotic cells

reproduce **asexually** by a type of cell division called **binary fission**
الأنشطار الثنائي

Eukaryotic cells

Cell Cycle

Interphase

First

- G1 (Gap 1) Phase-Cell mature
- S (Synthesis) Phase-DNA copied
- G2 (Gap 2) Phase- Cytoplasm increases

Second

- Cell could go through
 - **Mitosis** Or
 - **Meiosis**

Meiosis

Meiosis occurs in 2 phases;
Meiosis I, & **Meiosis II**

1- Prophase I
2- Prometaphase I
3- Metaphase I
4- Anaphase I
5-Telophase I
- (cytokinesis)

1- Prophase II
2- Prometaphase II
3- Metaphase II
4- Anaphase II
5-Telophase II
- (cytokinesis)

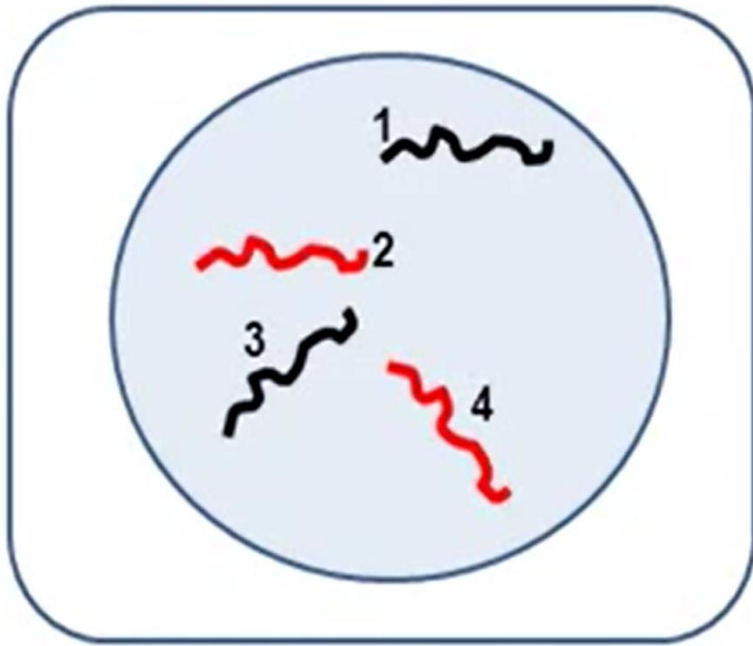
Mitosis

Mitotic phase

1- Prophase
2- Prometaphase
3- Metaphase
4- Anaphase
5-Telophase
- (cytokinesis)

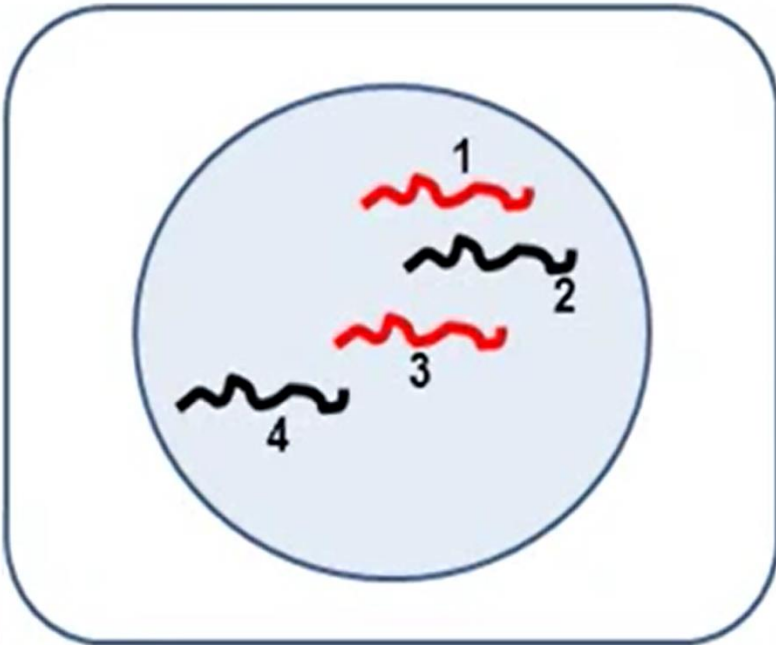
4 strands of DNA at the start

Interphase (S stage)
prior to mitosis



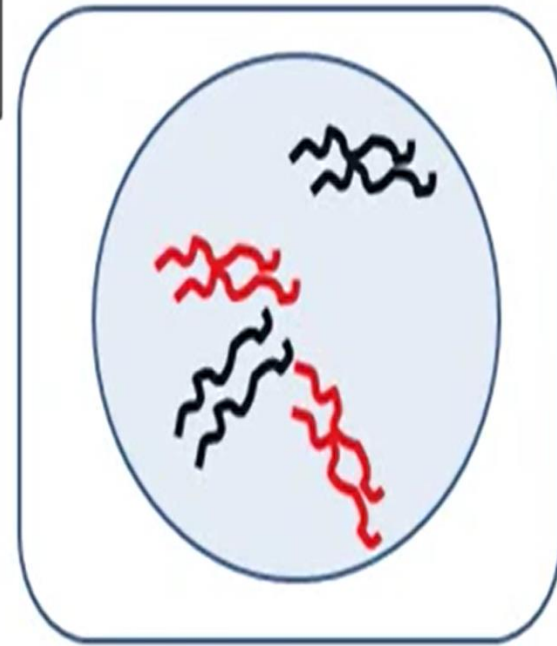
Interphase (S stage)
prior to meiosis

4 strands of DNA at the start



4 strands of DNA at the start

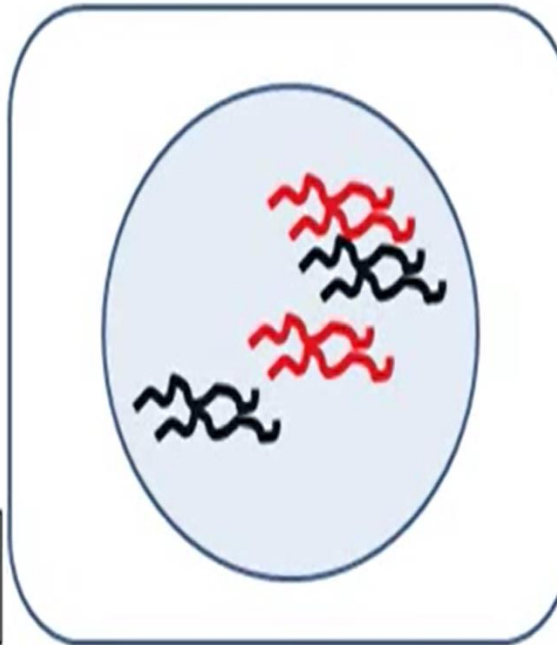
Interphase (S stage)
prior to mitosis



Chromatin duplicated

Interphase (S stage)
prior to meiosis

4 strands of DNA at the start



Chromatin duplicated

4 strands of DNA at the start

Prophase of mitosis



Nucleus dissolves

Prophase 1 of meiosis

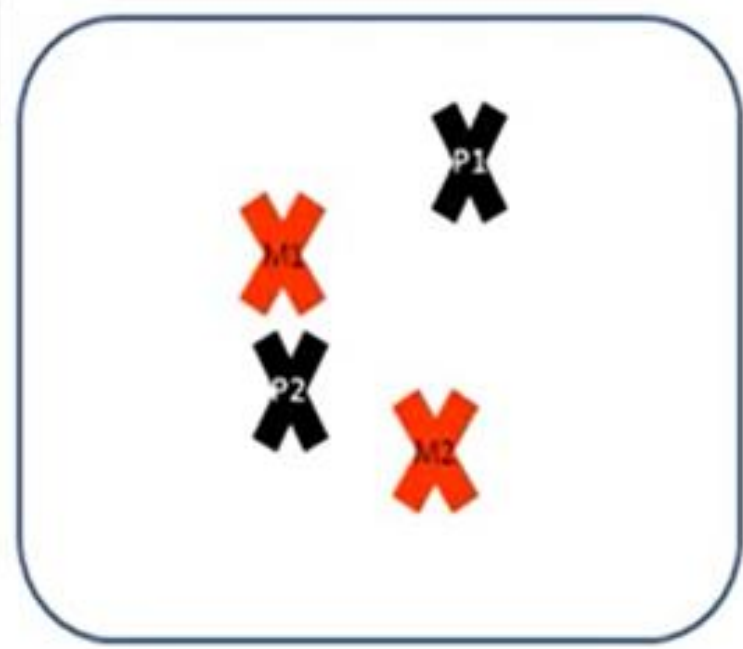


Nucleus dissolves

4 strands of DNA at the start

4 strands of DNA at the start

Prophase of mitosis

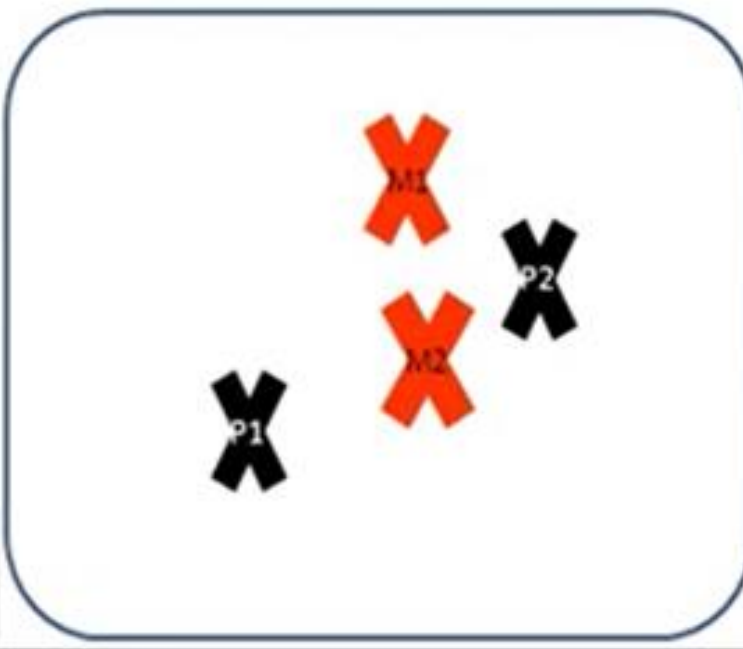


Nucleus dissolves

Chromatin coils into chromosomes

Key:
M = Maternal
P = Paternal

Prophase 1 of meiosis



Nucleus dissolves

Chromatin coils into chromosomes

4 strands of DNA at the start

4 strands of DNA at the start

Prophase of mitosis



Nucleus dissolves

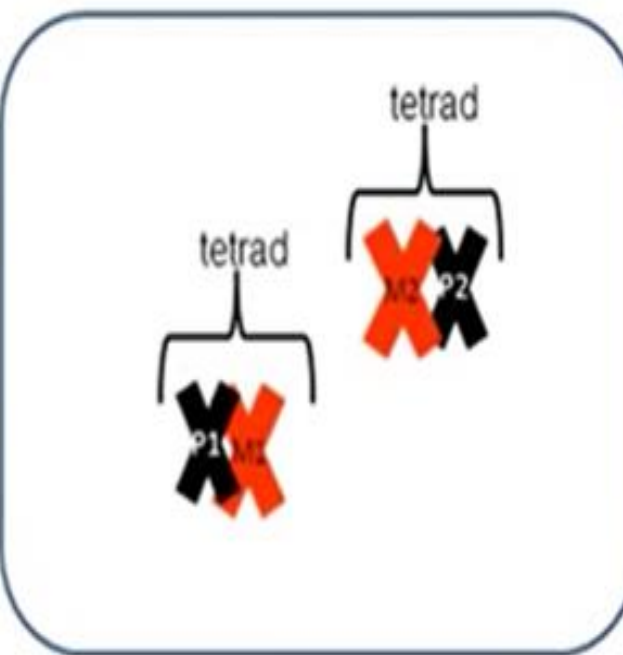
Chromatin coils into chromosomes

Key:

M = Maternal

P = Paternal

Prophase 1 of meiosis



Nucleus dissolves

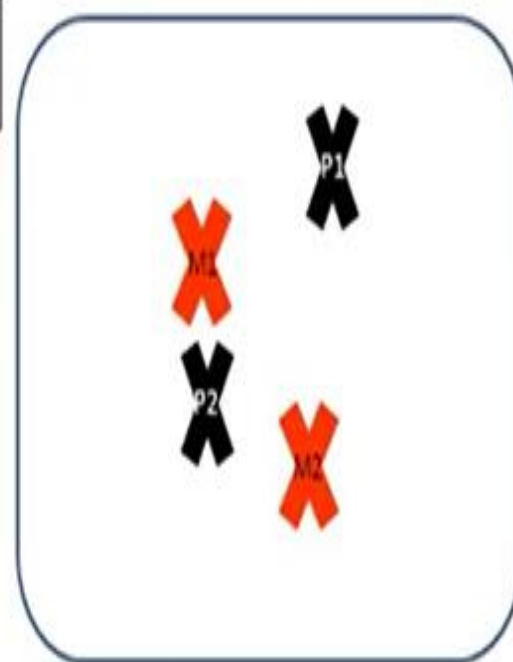
Chromatin coils into chromosomes

Synapsis occurs
(pairing of homologous chromosomes)

4 strands of DNA at the start

4 strands of DNA at the start

Prophase of mitosis



Nucleus dissolves

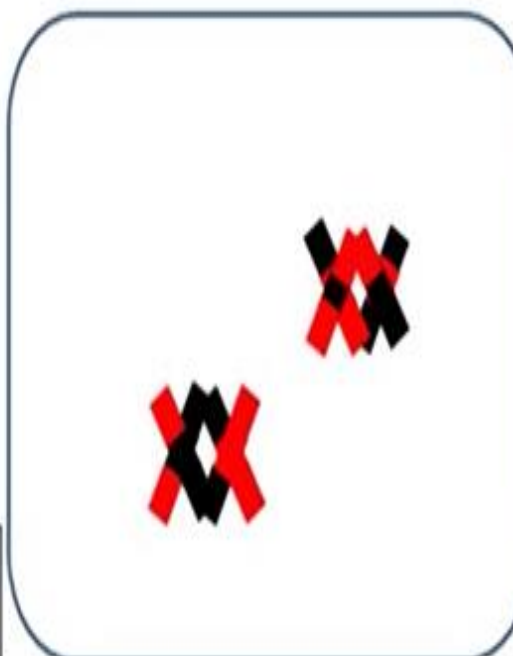
Chromatin coils into chromosomes

Key:

M = Maternal

P = Paternal

Prophase 1 of meiosis



Nucleus dissolves

Chromatin coils into chromosomes

Synapsis occurs

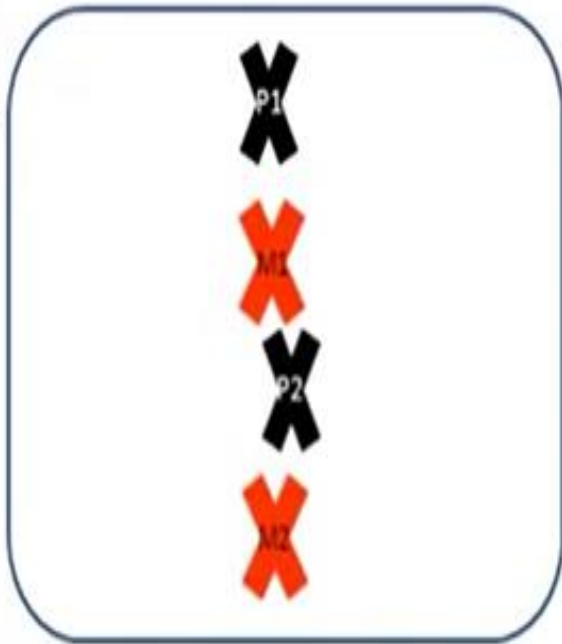
Crossing Over

4 strands of DNA at the start

4 strands of DNA at the start

Metaphase of mitosis

Key:
M = Maternal
P = Paternal



Chromosomes randomly pulled to middle of the cell



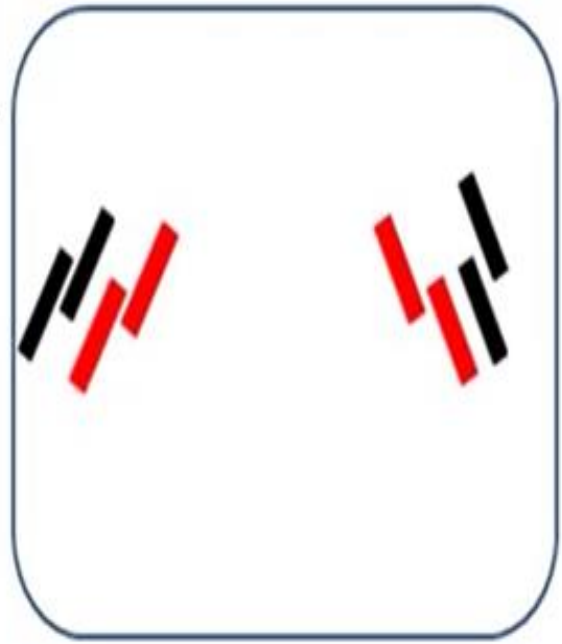
Metaphase 1 of meiosis

4 strands of DNA at the start

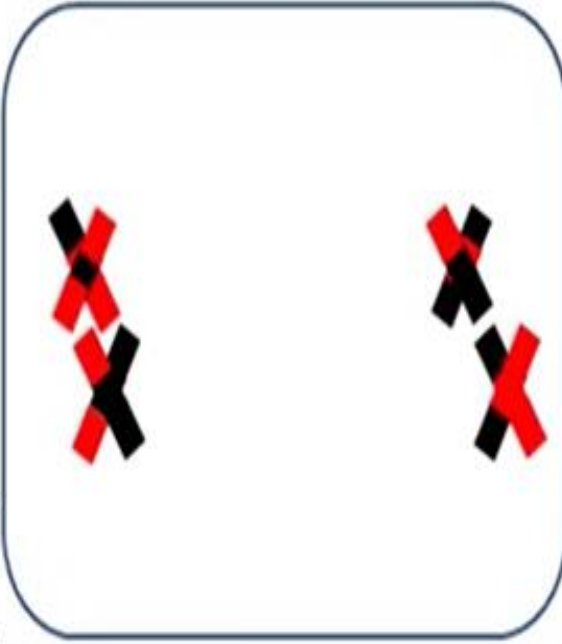
4 strands of DNA at the start

Anaphase of mitosis

Key:
M = Maternal
P = Paternal



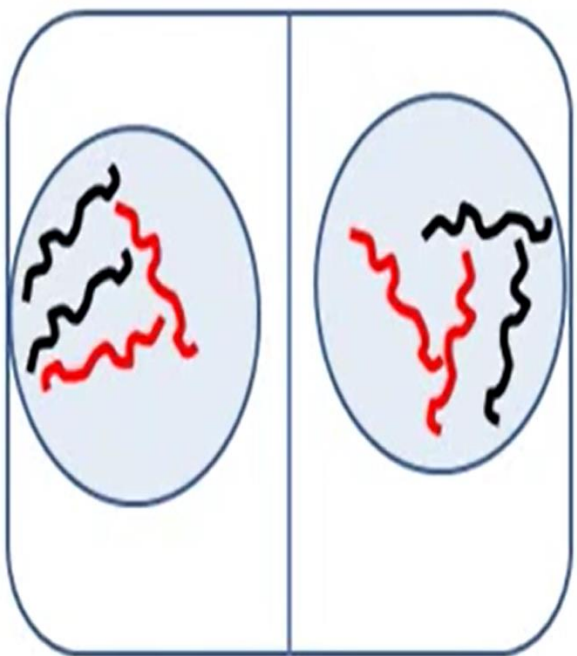
Chromatids pulled to opposite ends of the cell



Anaphase 1 of meiosis

4 strands of DNA at the start

4 strands of DNA at the start



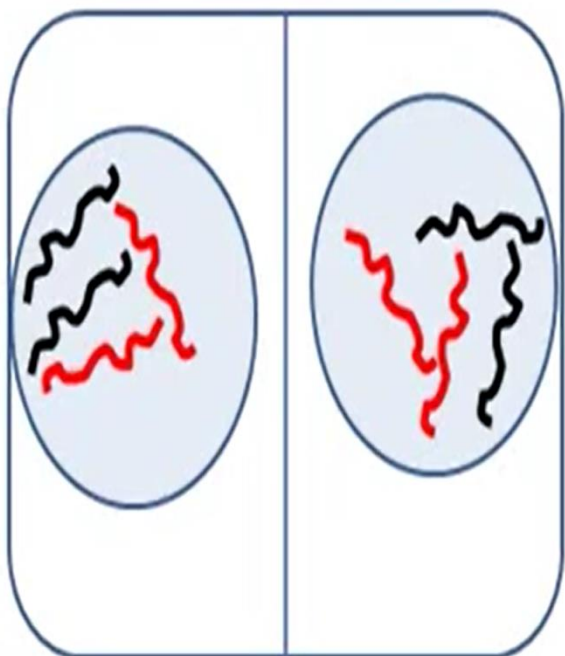
Cytokinesis splits the cell in half

Nucleus regrows

Chromatids unwind back into chromatin

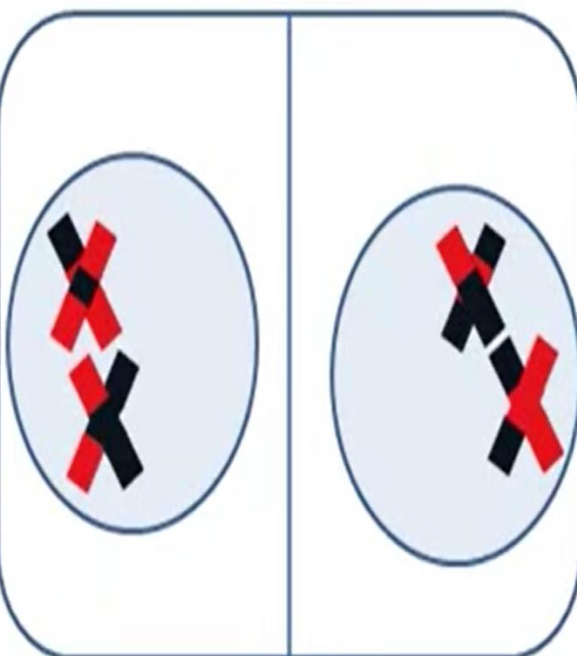
Telophase of mitosis

4 strands of DNA at the start



Mitosis End Result: two diploid cells

Telophase 1 of meiosis

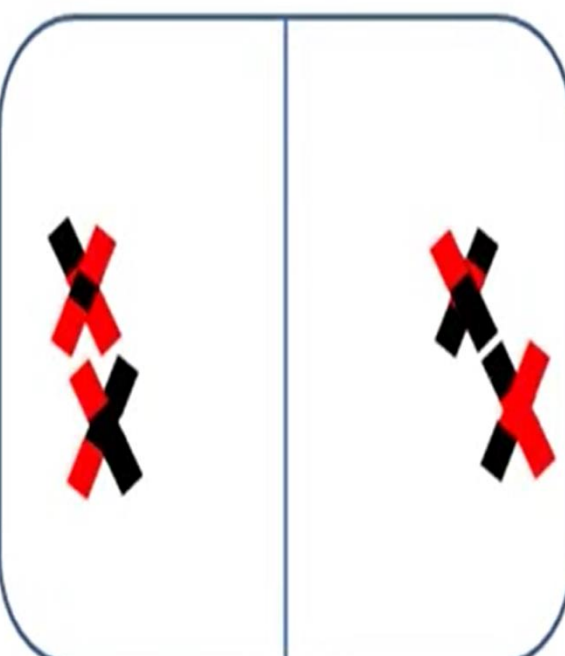


Cytokinesis splits the cell in half

Nucleus regrows

4 strands of DNA at the start

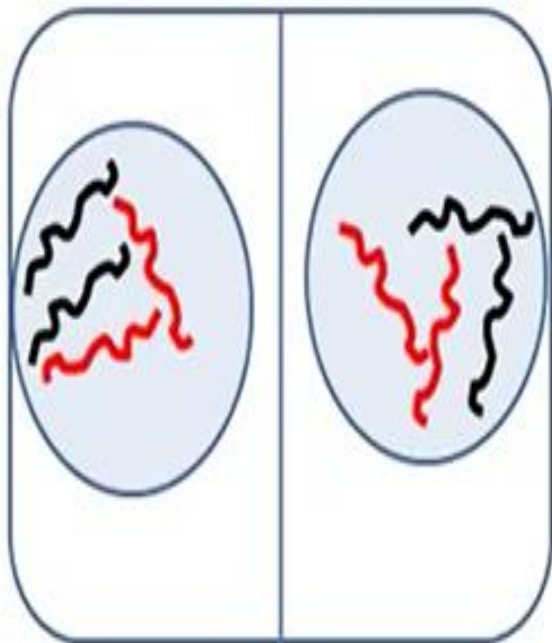
Prophase 2 of meiosis



Nucleus redissolves

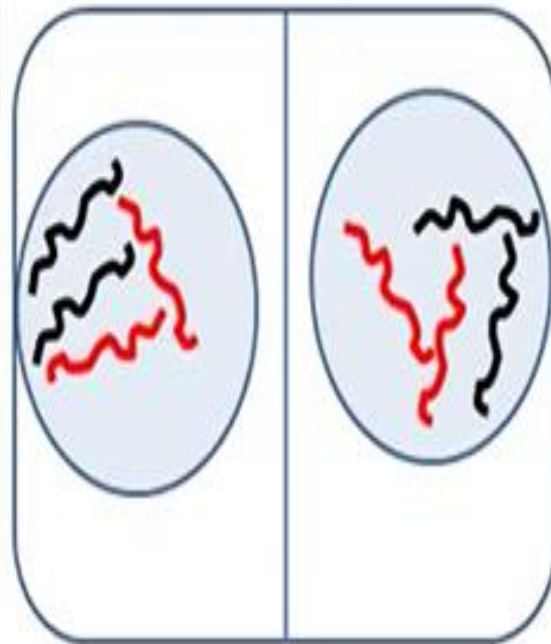
4 strands of DNA at the start

4 strands of DNA at the start



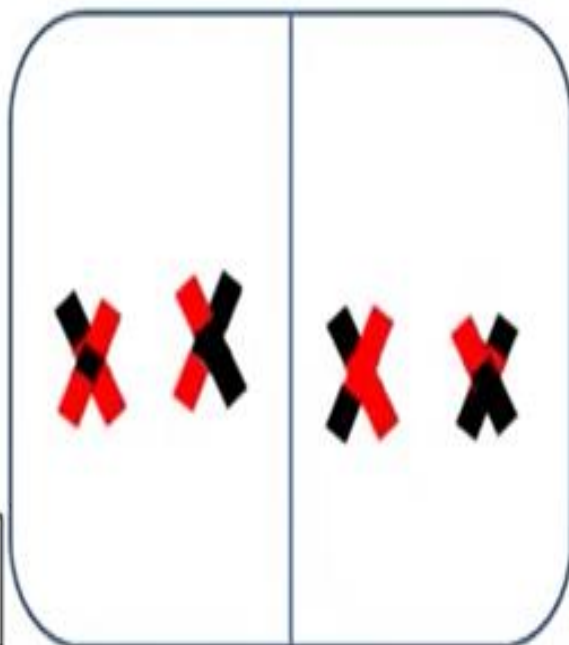
Mitosis End Result: two diploid cells

4 strands of DNA at the start



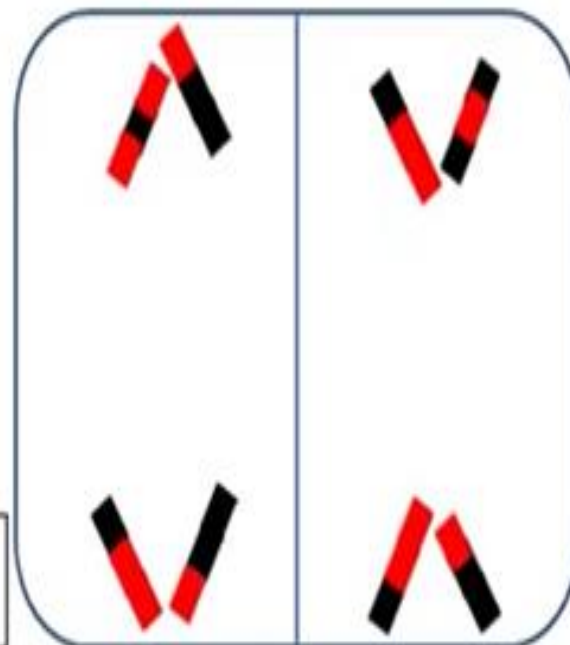
Mitosis End Result: two diploid cells

Metaphase 2 of meiosis



Chromosomes pulled to middle of the cell

Anaphase 2 of meiosis

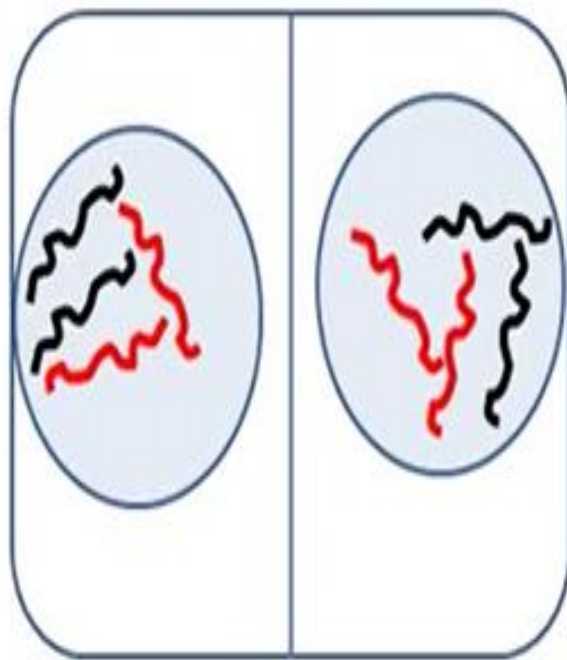


Chromatids pulled to opposite ends of the cell

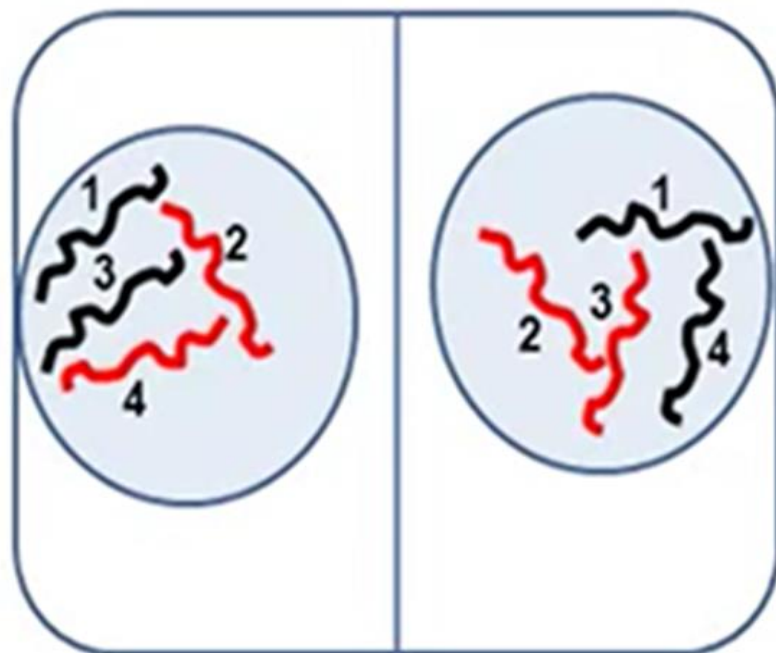
4 strands of DNA at the start

4 strands of DNA at the start

4 strands of DNA at the start



Mitosis End Result: two diploid cells



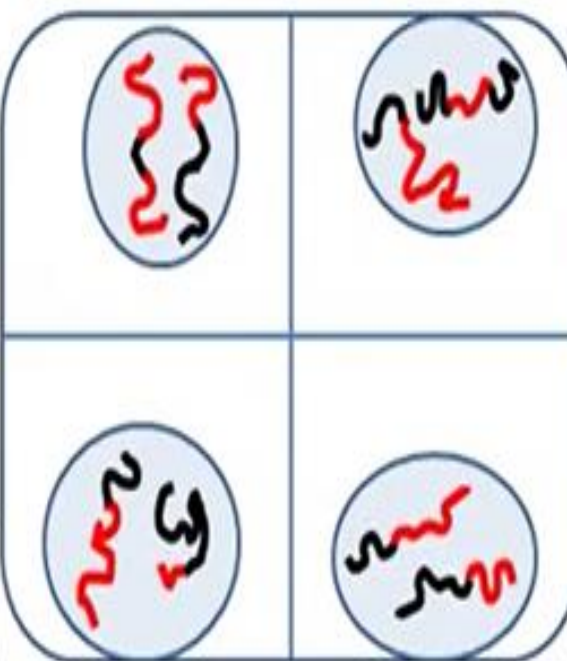
Mitosis End Result: two diploid cells

New cells have the same amount of chromatin from the start

Both cells are identical

Telophase 2 of meiosis

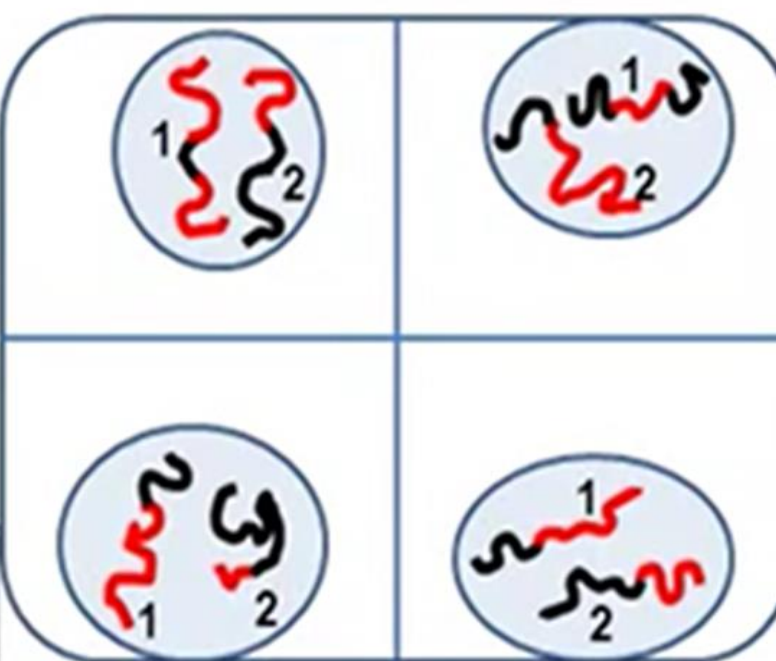
4 strands of DNA at the start



Cytokinesis splits the cells in half again

Nucleus reforms in all four cells

Chromatids unwind back into chromatin

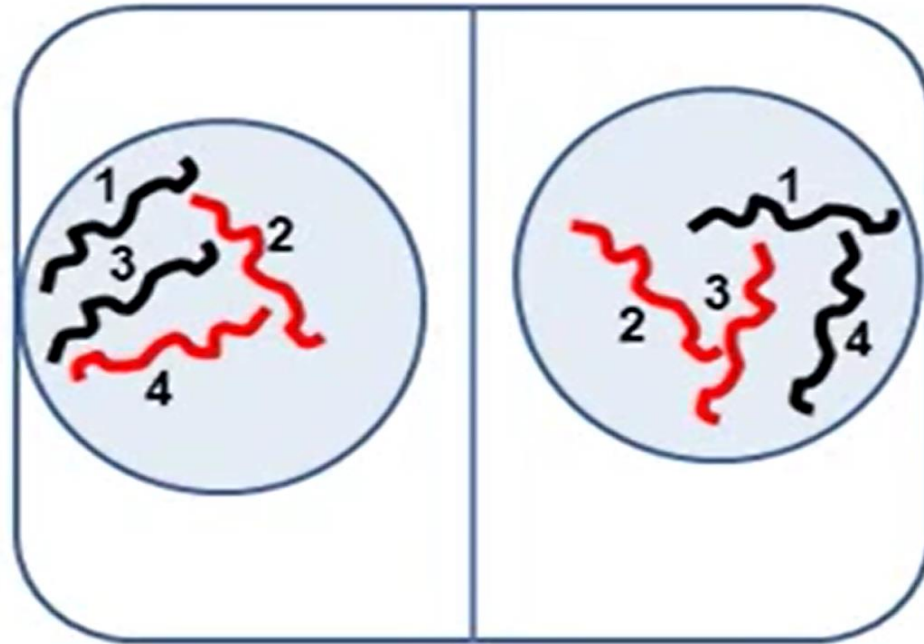


New cells have the half the amount of chromatin from the start

Each cell is genetically unique

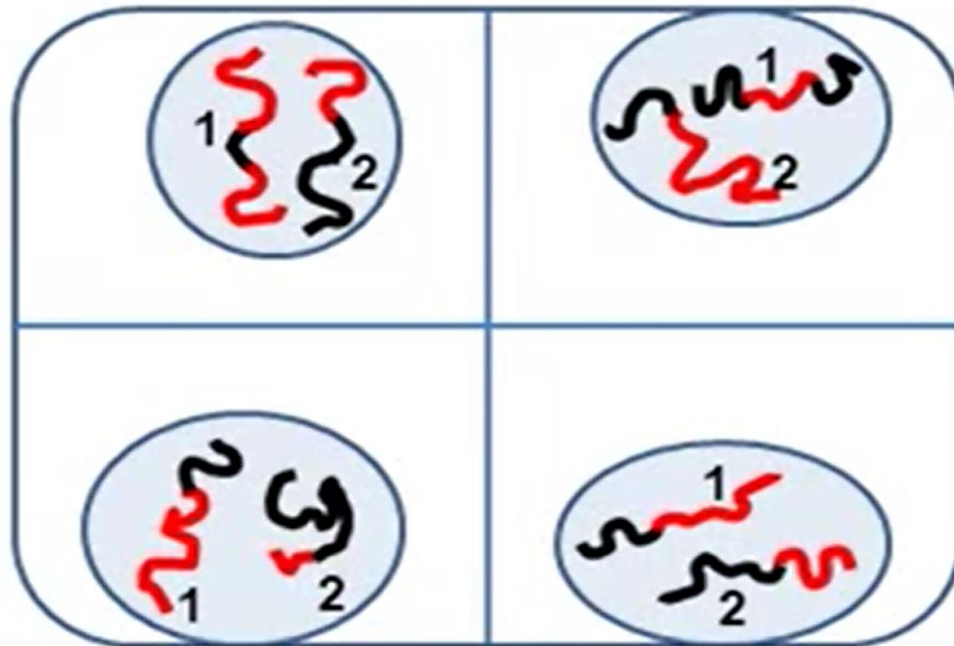
Meiosis End Result: four haploid cells

Cells that go through mitosis, start diploid...



...and end diploid.

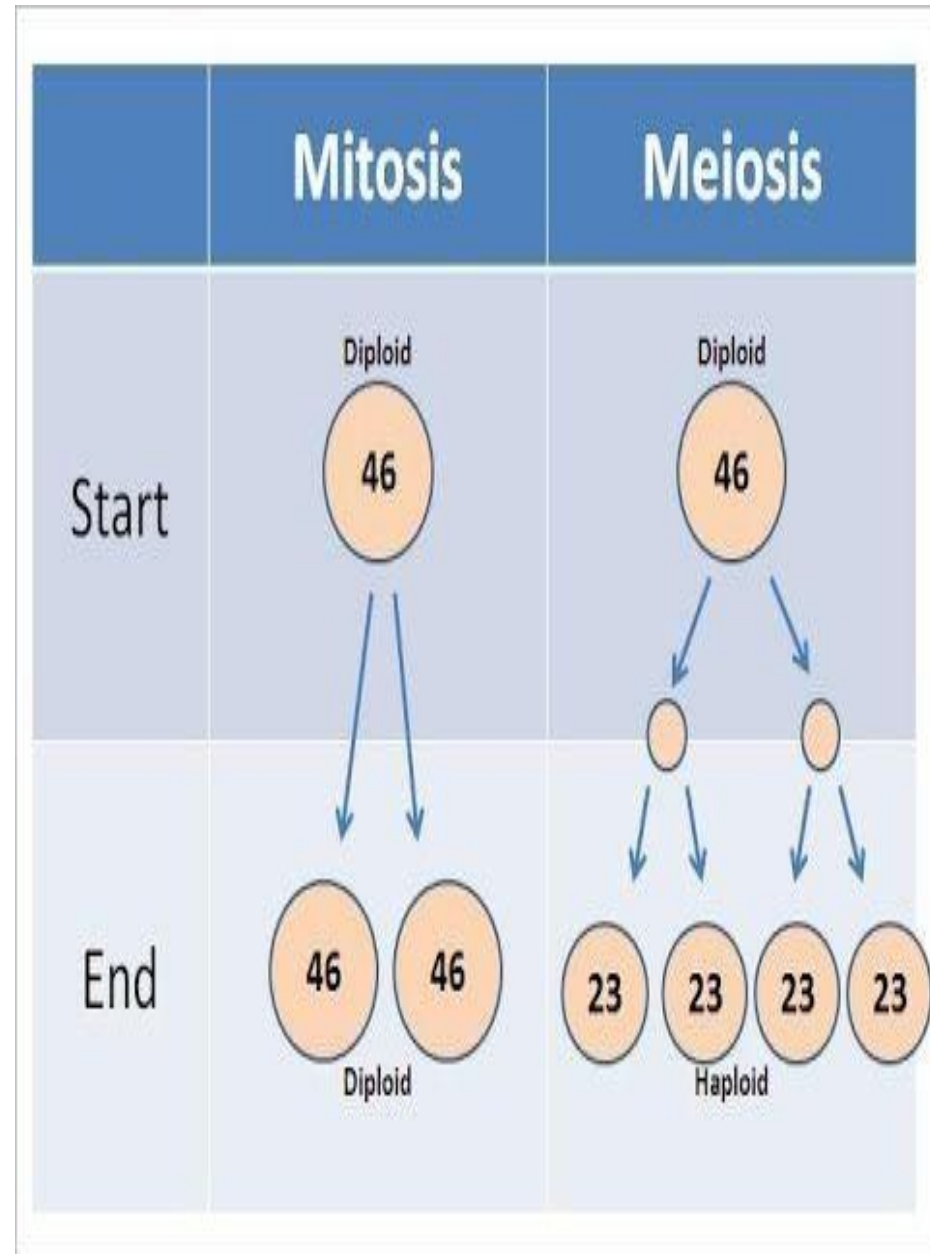
Cells that go through meiosis, start diploid...



...and end haploid.

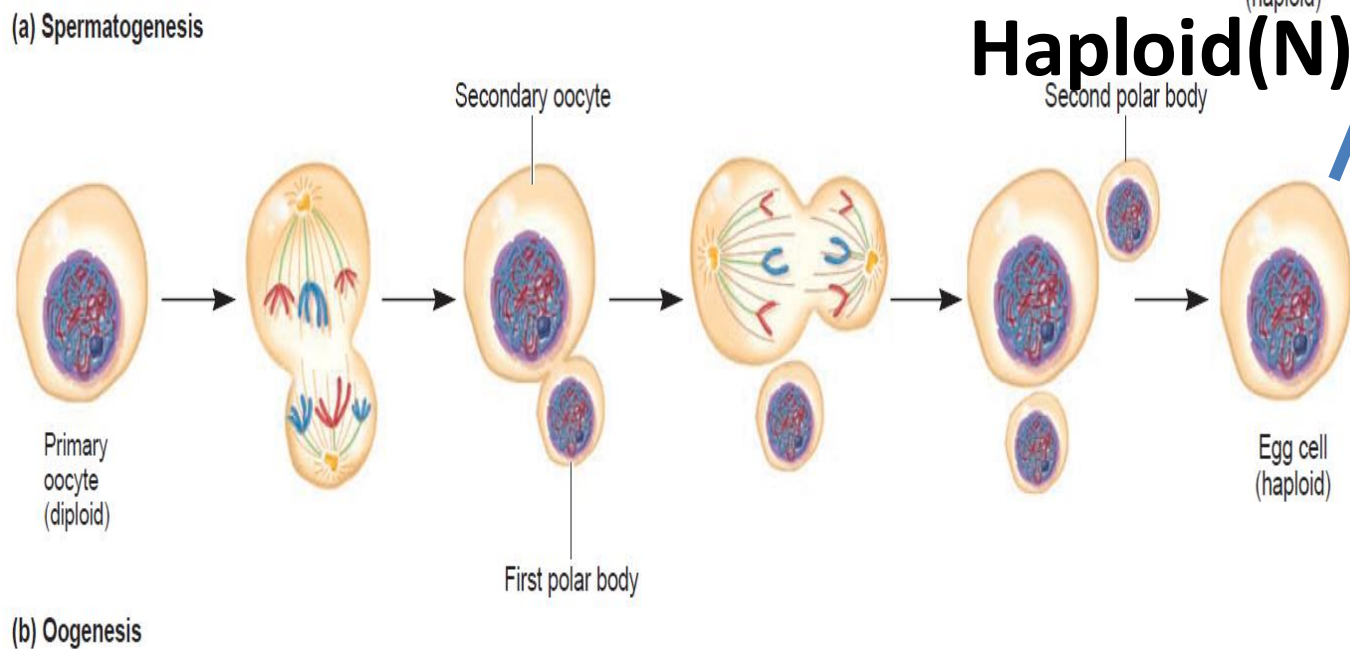
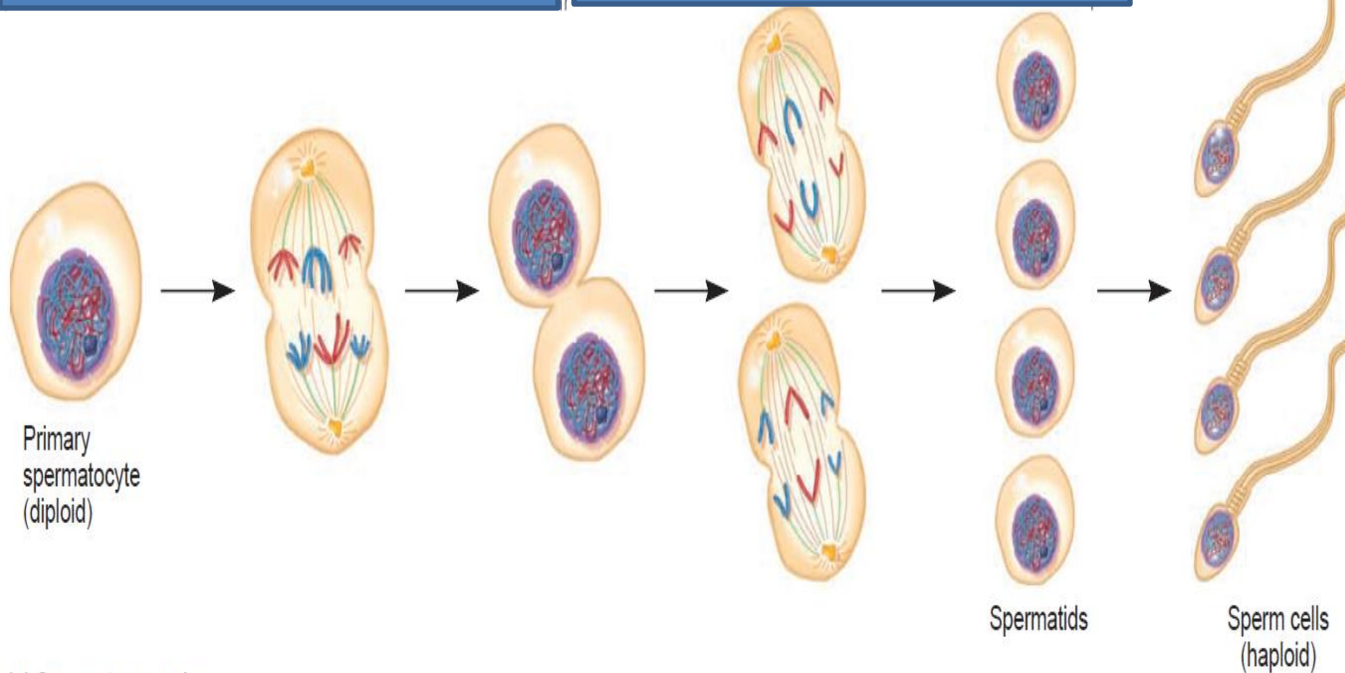
Differences in between Mitosis and Meiosis cell division

- There are two cell divisions (Meiosis I and Meiosis II) involves in meiosis cell division.
- As a results of Meiosis cell division, one parent cell gives 4 daughter cells & the chromosomes number reduced to half in the daughter cells
- Reduction of Chromosome number occurs in Meiosis I division
- Crossing over occurs in Meiosis I (prophase I)
- Meiosis II is just similar to Mitosis cell division.
- Mitosis cell division occurs in somatic cell but meiosis cell division occurs in reproductive cells



Meiosis I

Meiosis II

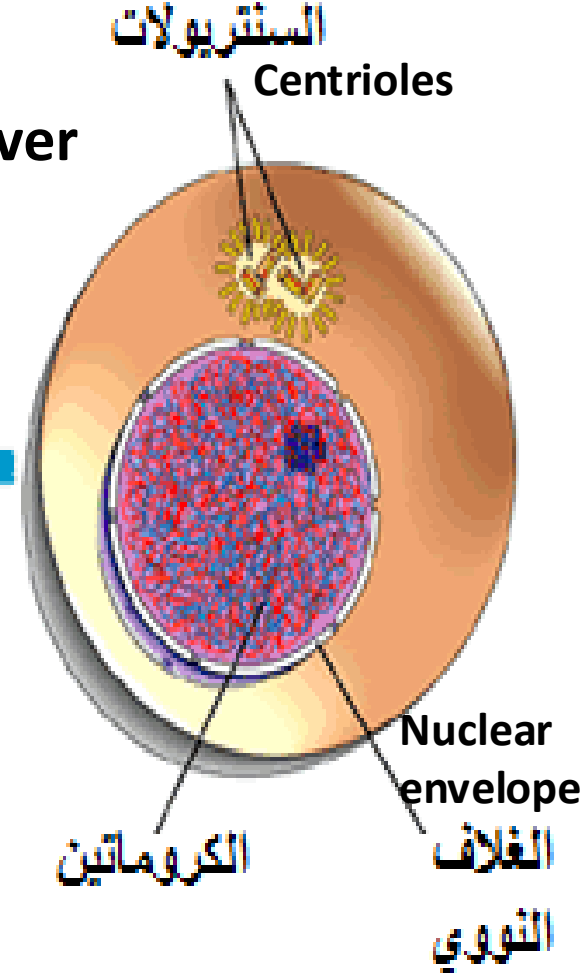


Zygote ($2n$)



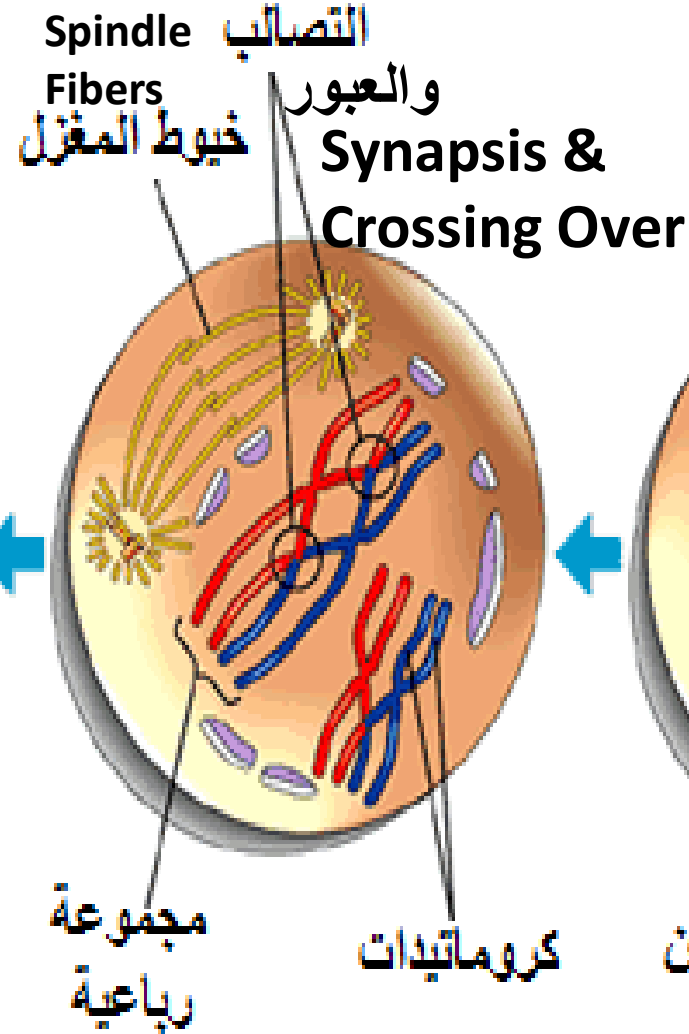
الإنقسام المئصف الأول Meiosis I

الطور البيني
Interphase



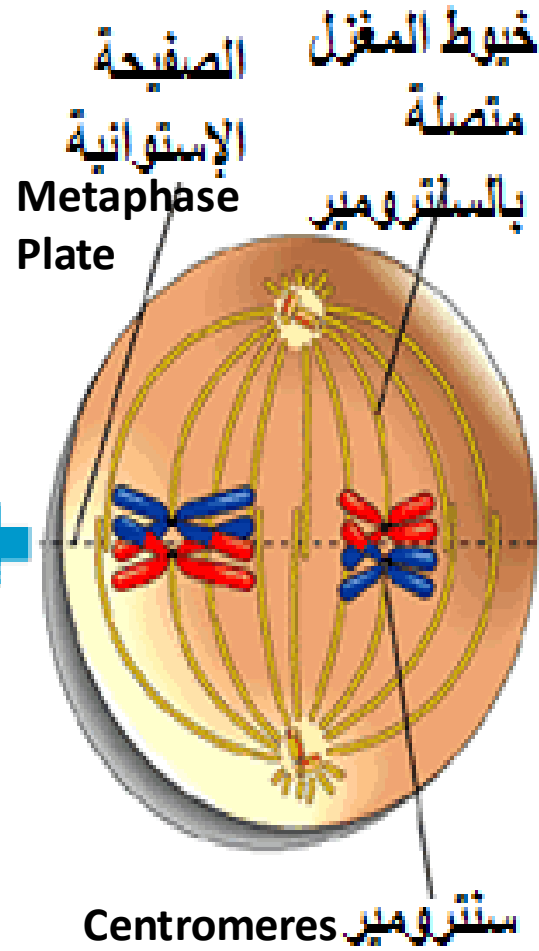
تتضاعف المادة الوراثية

الطور التمهيدي الأول
Prophase I



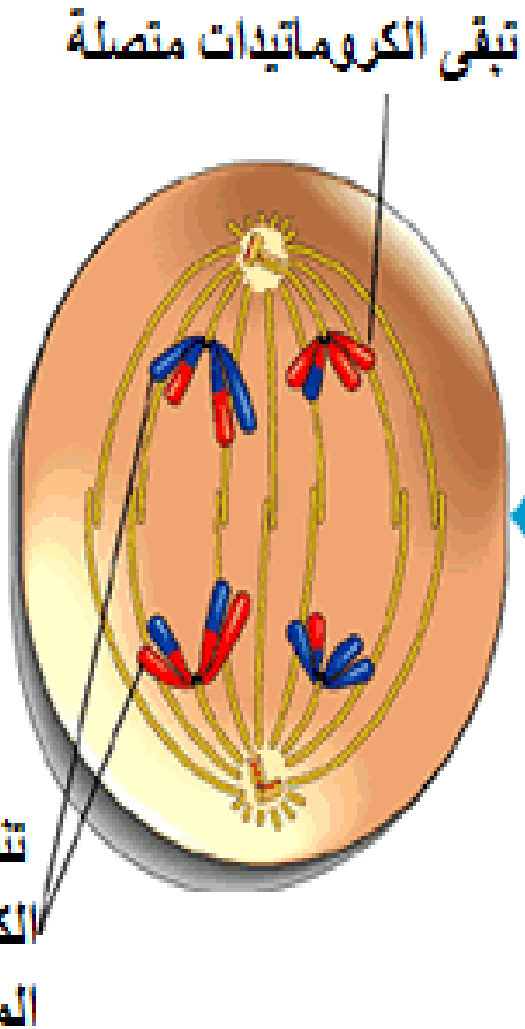
تتقترن الكروموسومات المتماثلة
وتتبادل الجينات بالعبور

الطور الاستوائي الأول
Metaphase I



تترتب الرباعيات
في خط الاستواء

الطور الانفصالي الأول
Anaphase I

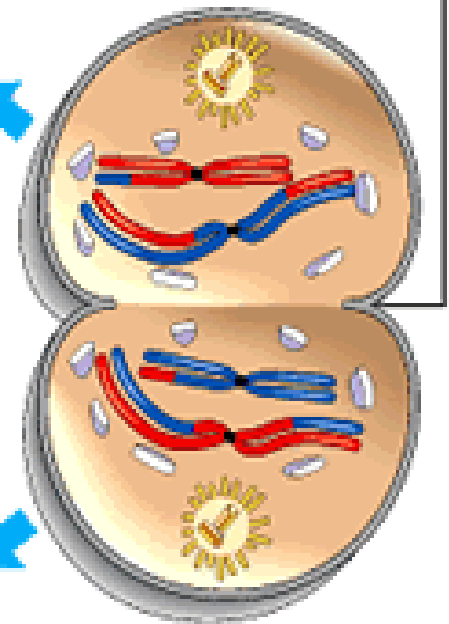


الإنقسام الميوزي الأول Meiosis I

الإنقسام الميوزي الثاني Meiosis II

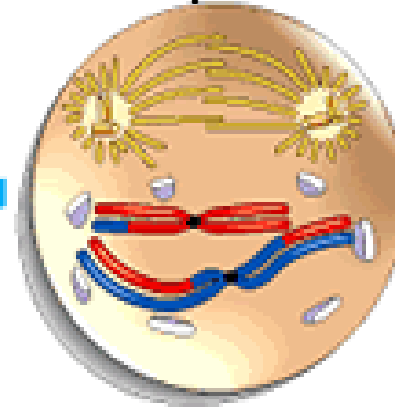
الطور النهائي الأول
Telophase I + cytokinesis

أخدود إنفصالي

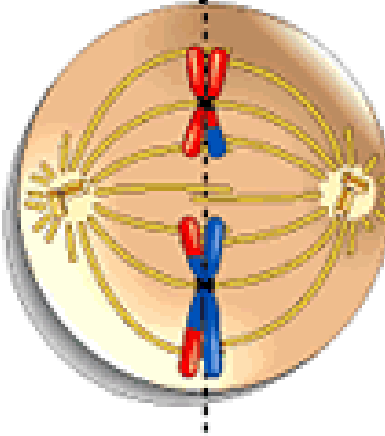


تتكون خليتين أحاديتي
العدد الكروموسومي، إلا
أن الكروموسومات لا تزال
متضاعفة

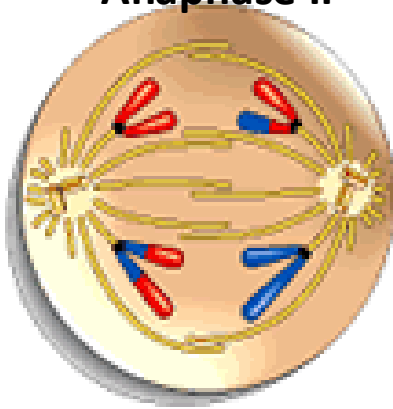
الطور التمهيدي II
Prophase II



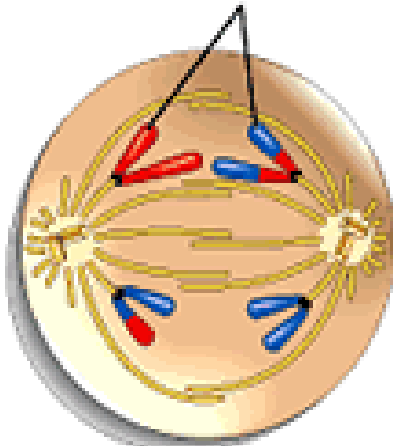
الطور الإستوائي II
Metaphase II



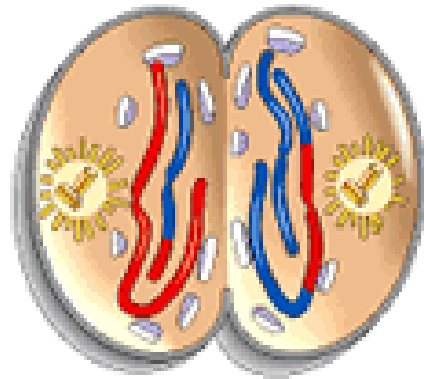
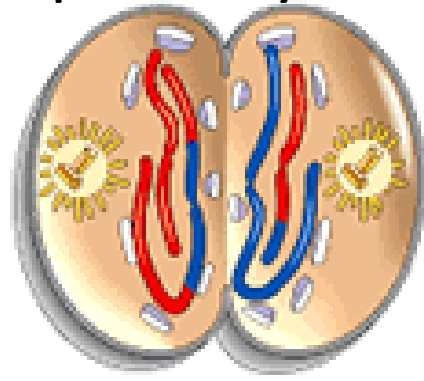
الطور الإنفصالي II
Anaphase II



إنفصال الكروماتيدات



الطور النهائي II
Telophase II + cytokinesis

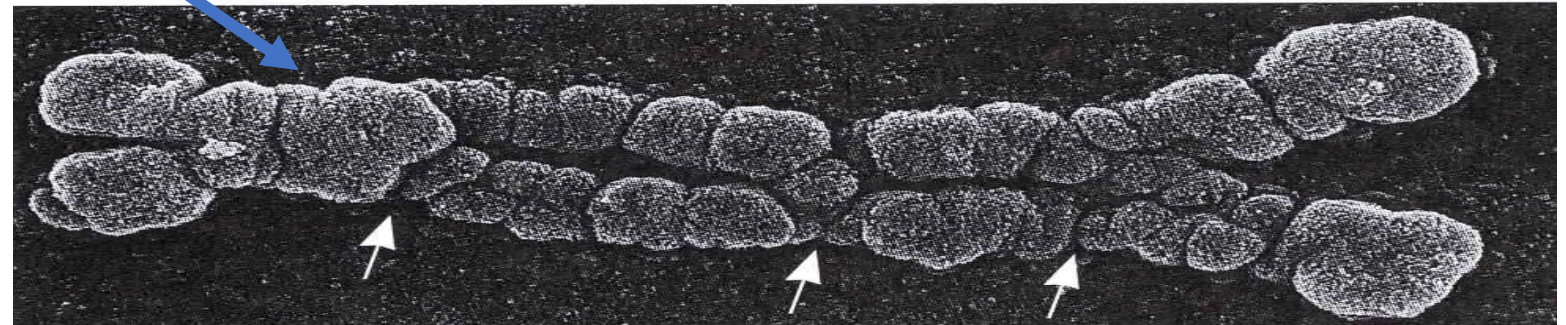


النتج النهائي: 4 خلايا
أحادية المجموعة
الكروموسومية (n)

Crossing over (contd.) عملية العبور: تبادل الأجزاء بين زوج من الكروموسومات المتماثلة

Exchange of genetic material between Homologous Chromosomes • **During Prophase I** occurs at *CHIASMA*

Chiasmata= the point where two homologous non-sister chromatids exchange genetic material during chromosomal crossover in meiosis



Produces new genetic combinations Of Chromosomes with both Maternal الأم & Paternal الأب components

تنتج تركيبات جينية جديدة من الكروموسومات من كل من المكونات الأبوية والأم

