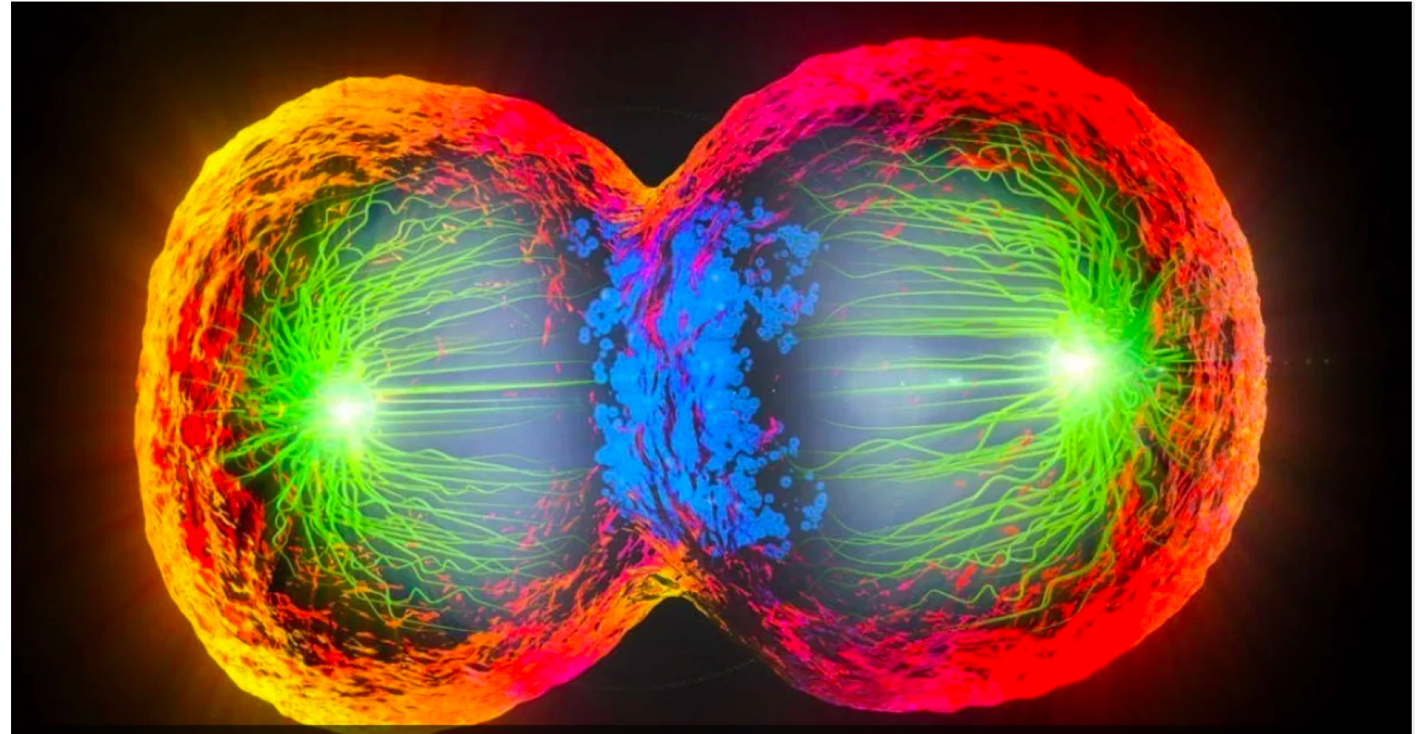


# Lesson 8

## Cell division



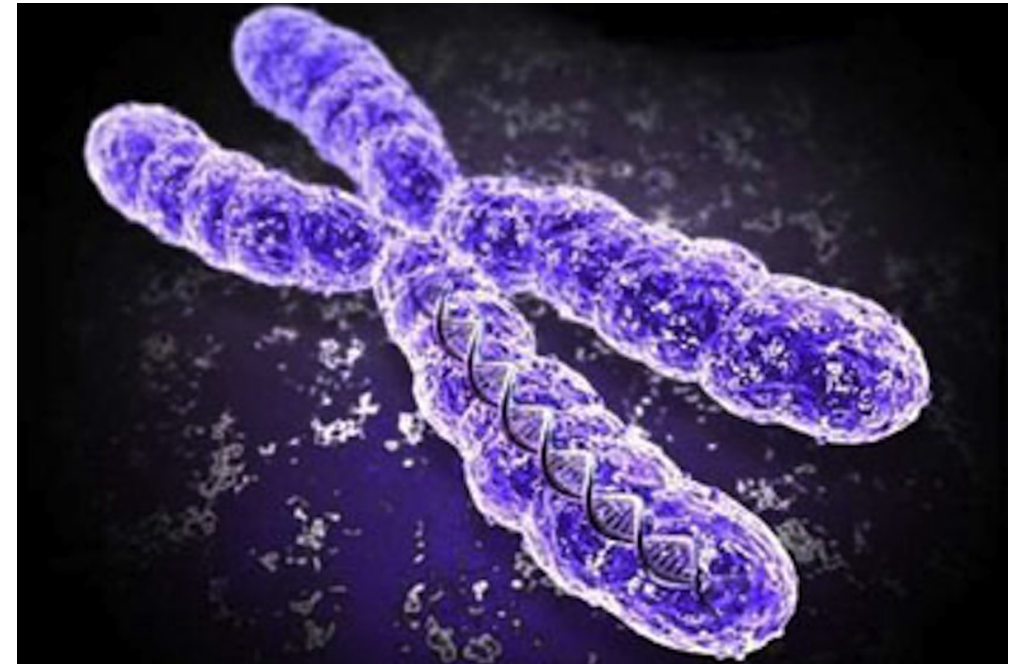
# Cell division

- Cells make more cells
- Cell division cycle
  1. DNA replication → make two sets of genes (DNA)
  2. DNA partitioning between daughter cells



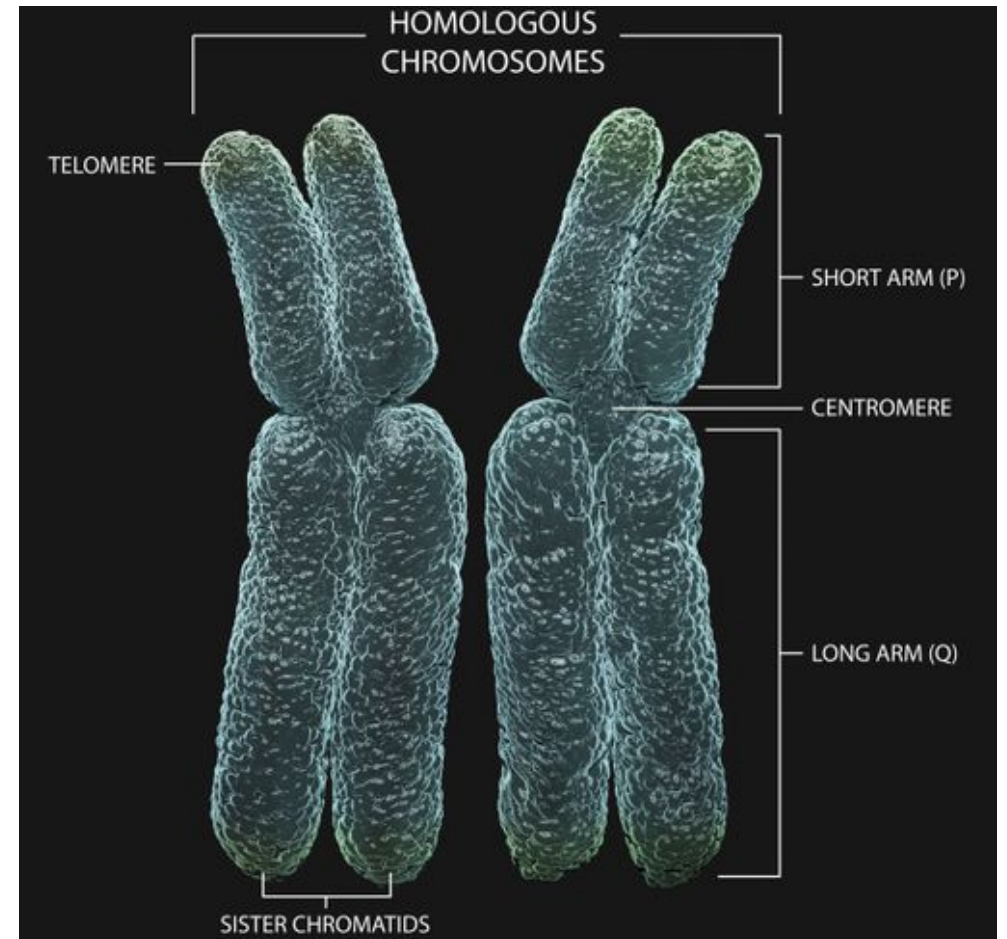
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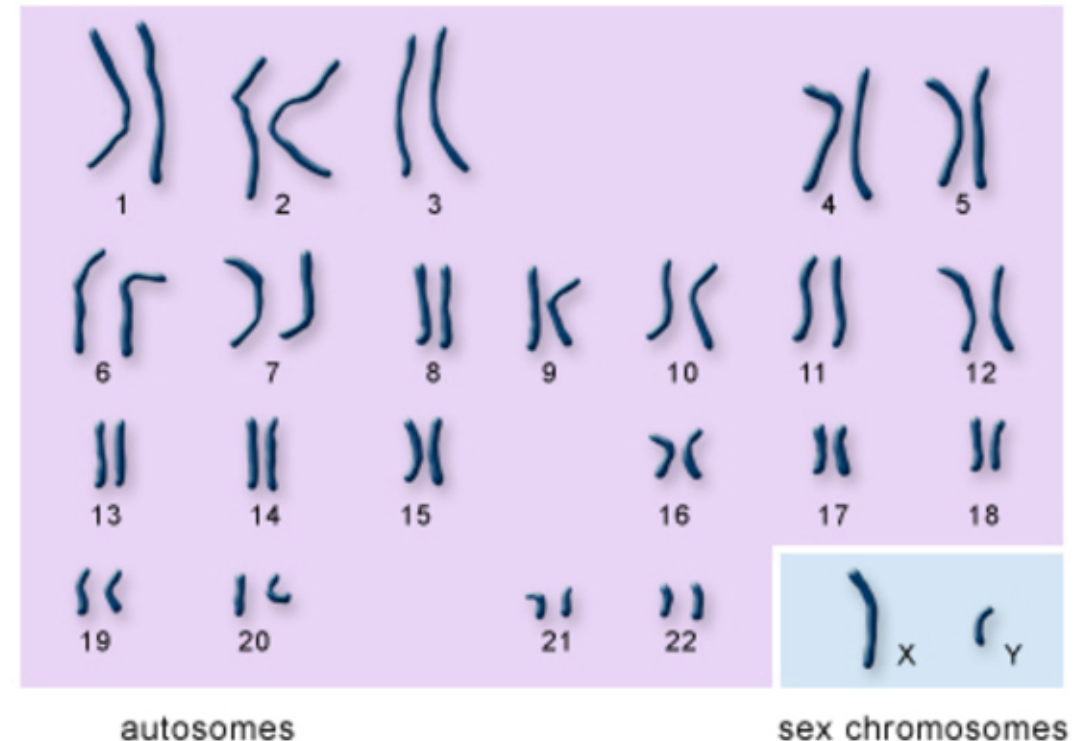
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  - somatic cells are **diploid** (2n)
- Each matching couple of chrs are called homologs or homologous chrs



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- Each matching couple of chrs are called homologs or homologous chrs
- Normal somatic cells have 23 couples of chrs
  - That makes 46 chrs in total
  - One chr couple is the sex chr (XX or XY)
  - the remaining 22 couples (aka autosomes) look the same in M/F

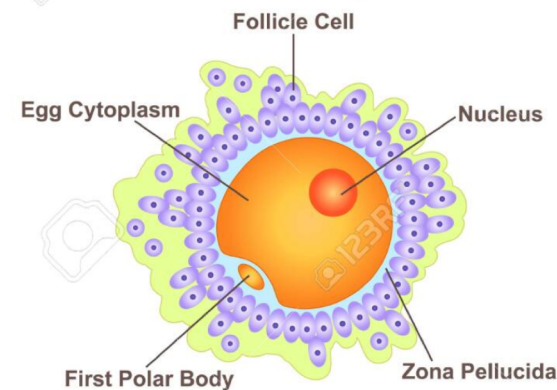


U.S. National Library of Medicine

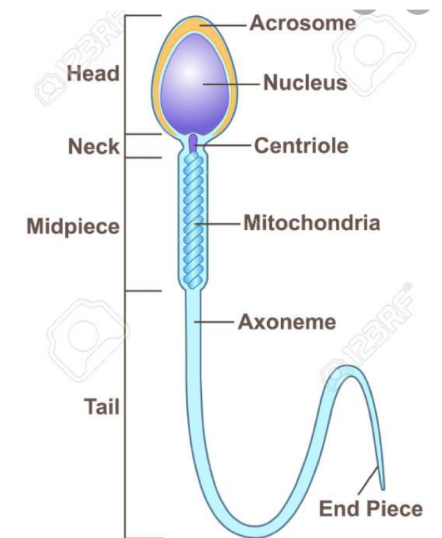
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  - That makes 46 chrs in total
  - One chr couple is the sex chr (XX or XY)
  - the remaining 22 couples (aka autosomes) look the same in M/F
- **Germ** cells --> **gametes** = egg/sperm
  - Gametes contain 1 of each chr
  - Gametes are **haploid** (n) germ cells

## Human Germ Cells



Ovum



Spermatozoon

# Cell division

- Two types of cell division
  - **Mitosis**
  - **Meiosis**

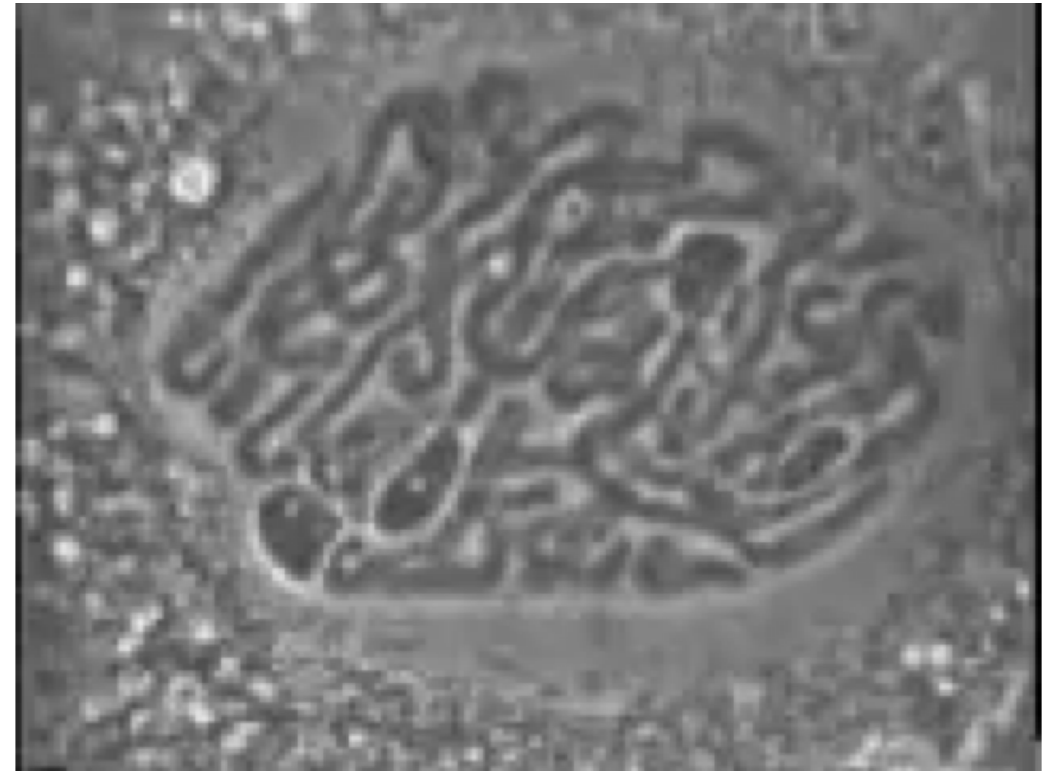
# Cell division - **MITOSIS**

- **Mitosis** occurs in **somatic** cells
- Outcome = **2** daughter cells **identical** to the parent cell (**2n**)
- The mitotic process in brief:
  - Chrs (DNA) replicate → **sister chromatids**
  - Sister chromatids line up on a special structure called **mitotic spindle**
  - Sister chromatids segregate
    - One copy of each chr is partitioned to each daughter cell (2n)
  - Cell membrane partitions the two daughter cells



# Cell division - **MITOSIS**

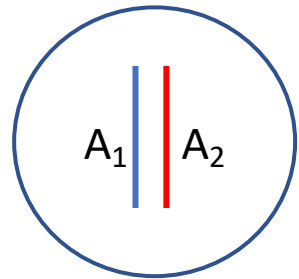
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  - Cell membrane partitions the two daughter cells
- **1 diploid mother cell ( $2n$ ) → 2 diploid daughter cells ( $2n$ )**



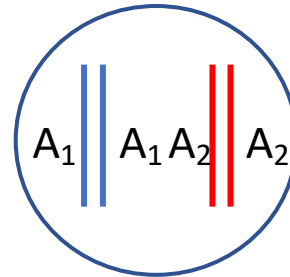
# Cell division - MITOSIS

Diploid ( $2n$ ) cell with 1 homolog

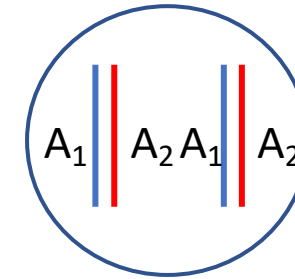
Sister chromatid



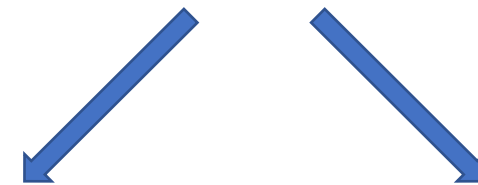
DNA REPLICATION



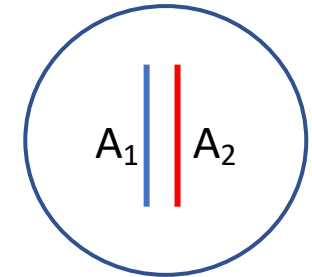
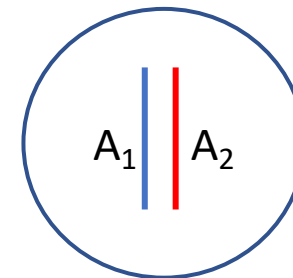
SISTER CHROMATID  
SEGREGATION



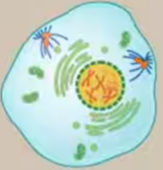
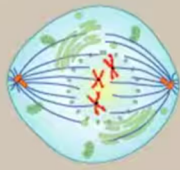
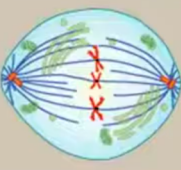
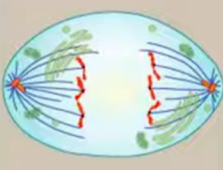
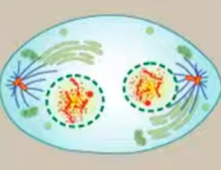
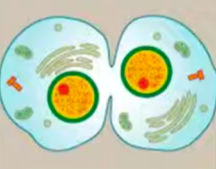
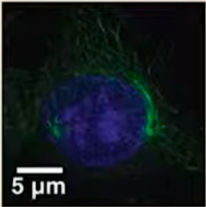
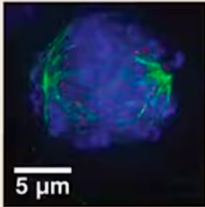
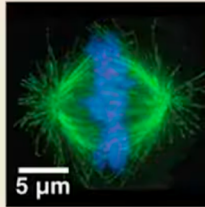
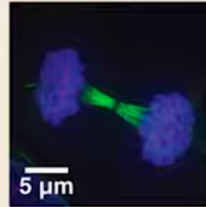
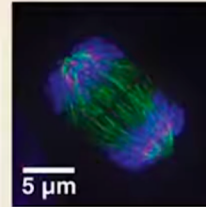
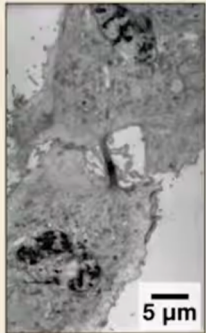
Homologs partitioning into  
daughter cells

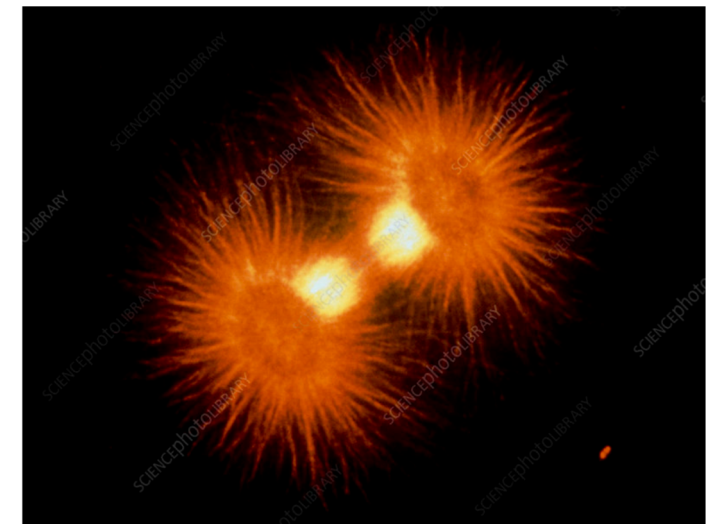
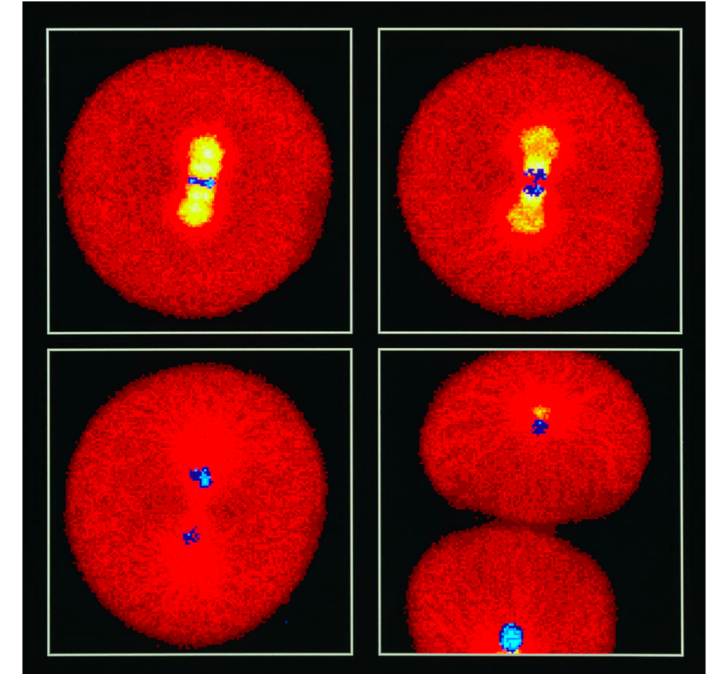


Two diploid ( $2n$ ) daughter cells identical to the  
parent cell



# Cell division - MITOSIS

Prophase	Prometaphase	Metaphase	Anaphase	Telophase	Cytokinesis
					
<ul style="list-style-type: none"> <li>Chromosomes condense and become visible</li> <li>Spindle fibers emerge from the centrosomes</li> <li>Nuclear envelope breaks down</li> <li>Centrosomes move toward opposite poles</li> </ul>	<ul style="list-style-type: none"> <li>Chromosomes continue to condense</li> <li>Kinetochores appear at the centromeres</li> <li>Mitotic spindle microtubules attach to kinetochores</li> </ul>	<ul style="list-style-type: none"> <li>Chromosomes are lined up at the metaphase plate</li> <li>Each sister chromatid is attached to a spindle fiber originating from opposite poles</li> </ul>	<ul style="list-style-type: none"> <li>Centromeres split in two</li> <li>Sister chromatids (now called chromosomes) are pulled toward opposite poles</li> <li>Certain spindle fibers begin to elongate the cell</li> </ul>	<ul style="list-style-type: none"> <li>Chromosomes arrive at opposite poles and begin to decondense</li> <li>Nuclear envelope material surrounds each set of chromosomes</li> <li>The mitotic spindle breaks down</li> <li>Spindle fibers continue to push poles apart</li> </ul>	<ul style="list-style-type: none"> <li>Animal cells: a cleavage furrow separates the daughter cells</li> <li>Plant cells: a cell plate, the precursor to a new cell wall, separates the daughter cells</li> </ul>
					
5 μm	5 μm	5 μm	5 μm	5 μm	5 μm
MITOSIS					

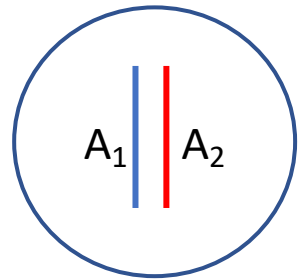


# Cell division - **MEIOSIS**

- Production of gametes (egg/sperm, haploid) from diploid germ cells
- Outcome:
  - **4** cells
  - **non-identical to the parent**
  - each daughter cell (egg/sperm) is **haploid** →  $n = 1$  copy of each chr
- The meiotic process in brief:
  - Chrs (DNA) replicate → **sister chromatids**
  - Sister chromatids come close one another and exchange DNA segments (**chiasma, crossing-over**)
    - Ensures individual genetic variability
  - Meiosis 1
    - Each replicated homologous chr pair goes to daughter cells
    - Output is two diploid cells
  - Meiosis 2
    - The two daughter cells divide again
    - Single homolog goes to each new daughter cell
    - Output is 4 haploid cells

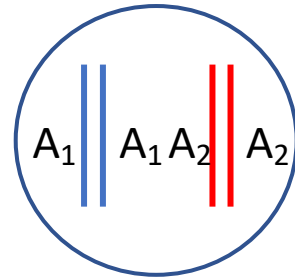
# Cell division - MEIOSIS

Diploid ( $2n$ ) cell with 1 homolog

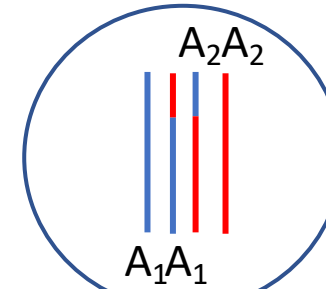


DNA REPLICATION

Sister chromatid

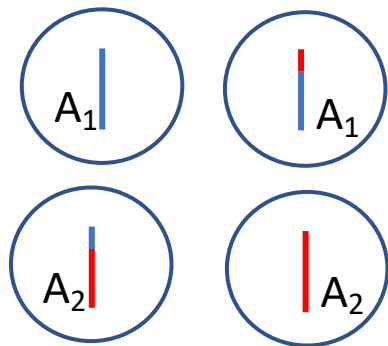


CHIASMA  
CROSSING OVER



SISTER CHROMATID  
SEGREGATION

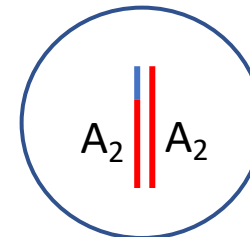
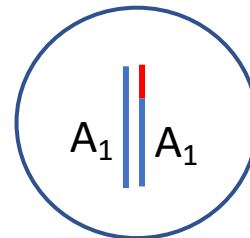
Four haploid ( $n$ ) daughter cells  
non-identical to the parent cell



SISTER CHROMATID  
PARTITIONING  
INTO DAUGHTER CELLS

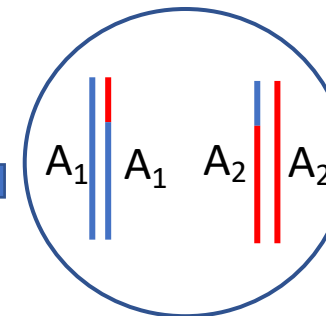
MEIOSIS 2

Two diploid ( $2n$ ) daughter cells  
non-identical to the parent cell



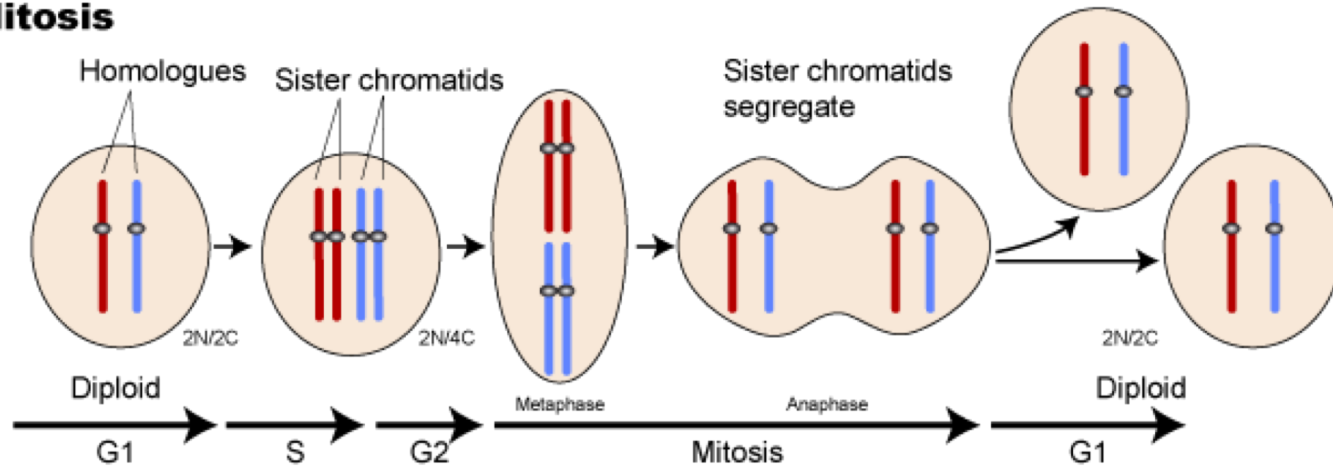
SISTER CHROMATID  
PARTITIONING  
INTO DAUGHTER CELLS

MEIOSIS 1

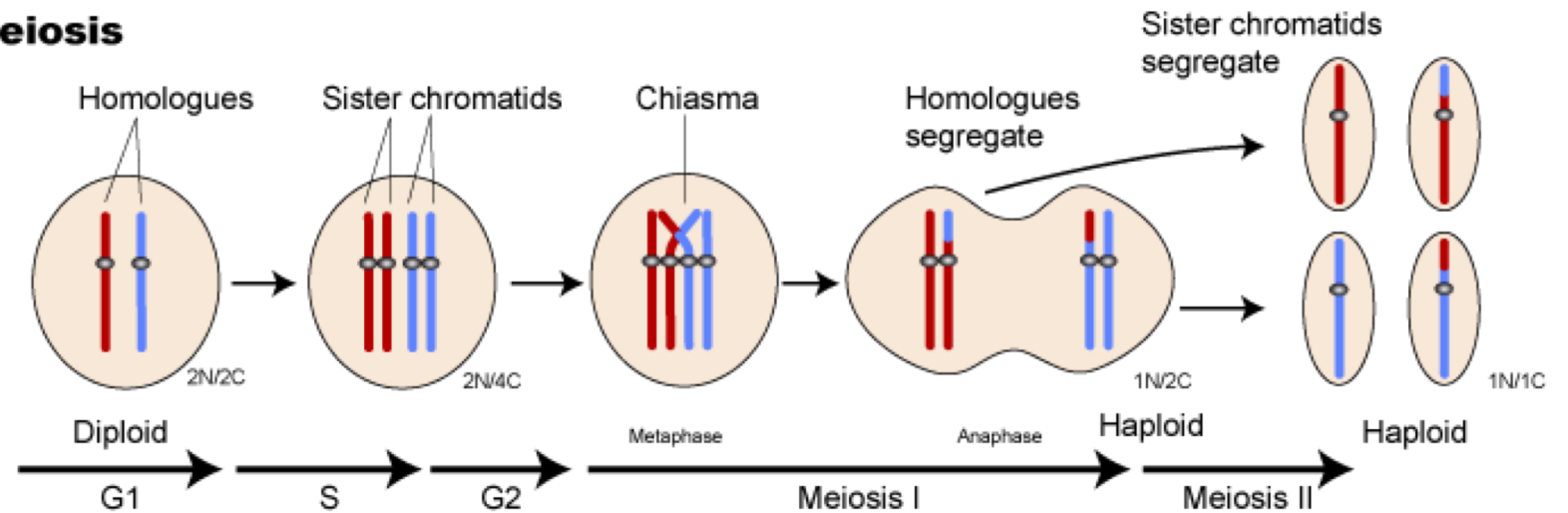


# Cell division – Mitosis vs. Meiosis

## Mitosis



## Meiosis



# Cellular division

- Take assignment 8: **Cell division**