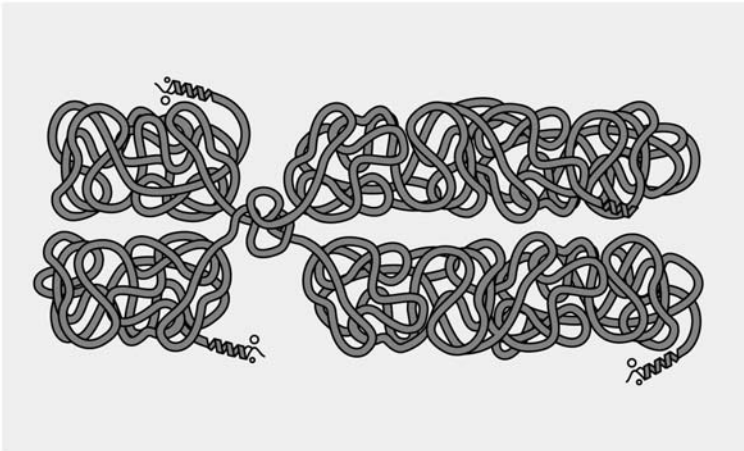
Mitosis & Meiosis

- Chromosomal structure
- Cell Cycle
- Interphase & Mitosis
- Meiosis--Reduction Division

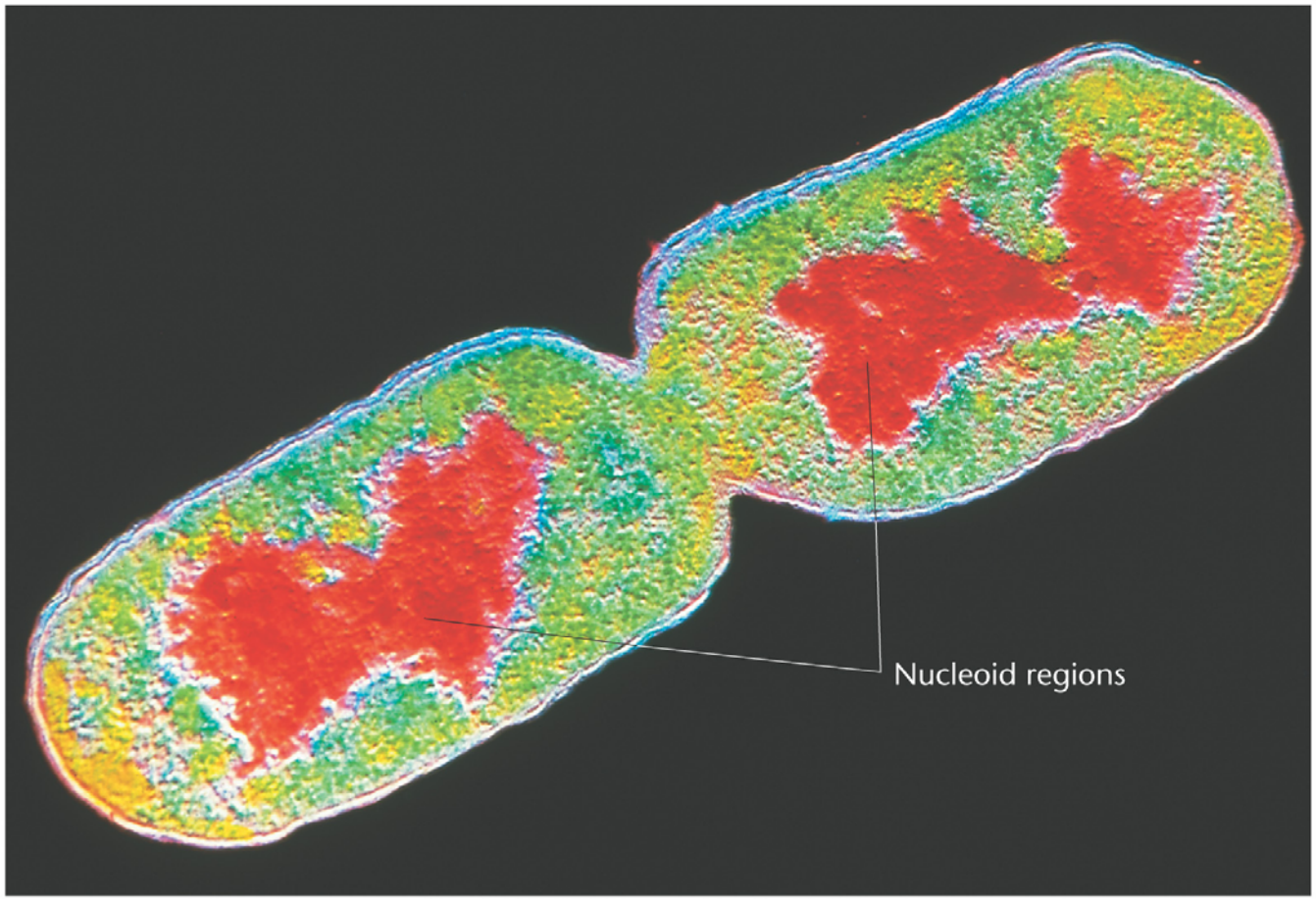
Chromosomal structure

- DNA (2 strands)
- Associated with proteins (Euk= Histones)
- Chromatin
- Centromere
- Haploid
- Diploid
- Homologous chromosomes



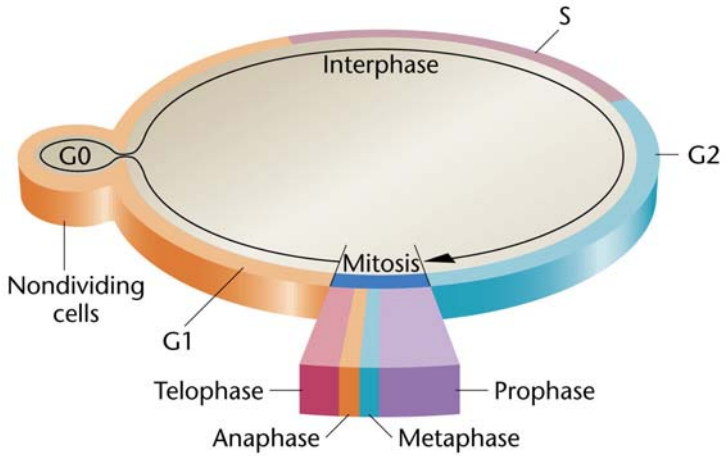
Centromere location	Designation	Metaphase shape	Anaphase shape
Middle	Metacentric	p arm, Centromere, q arm	Migration
Between middle and end	Submetacentric		
Close to end	Acrocentric		
At end	Telocentric		

Prokaryotic cells



Cell Cycle

- Production of new cells for repair, growth
- Interphase (3 stages)
- Mitosis = separation of chromosomes
- Go
- Environmental factors
- Hormonal factors



Interphase			Mitosis
G1	S	G2	M
5	7	3	1

Hours

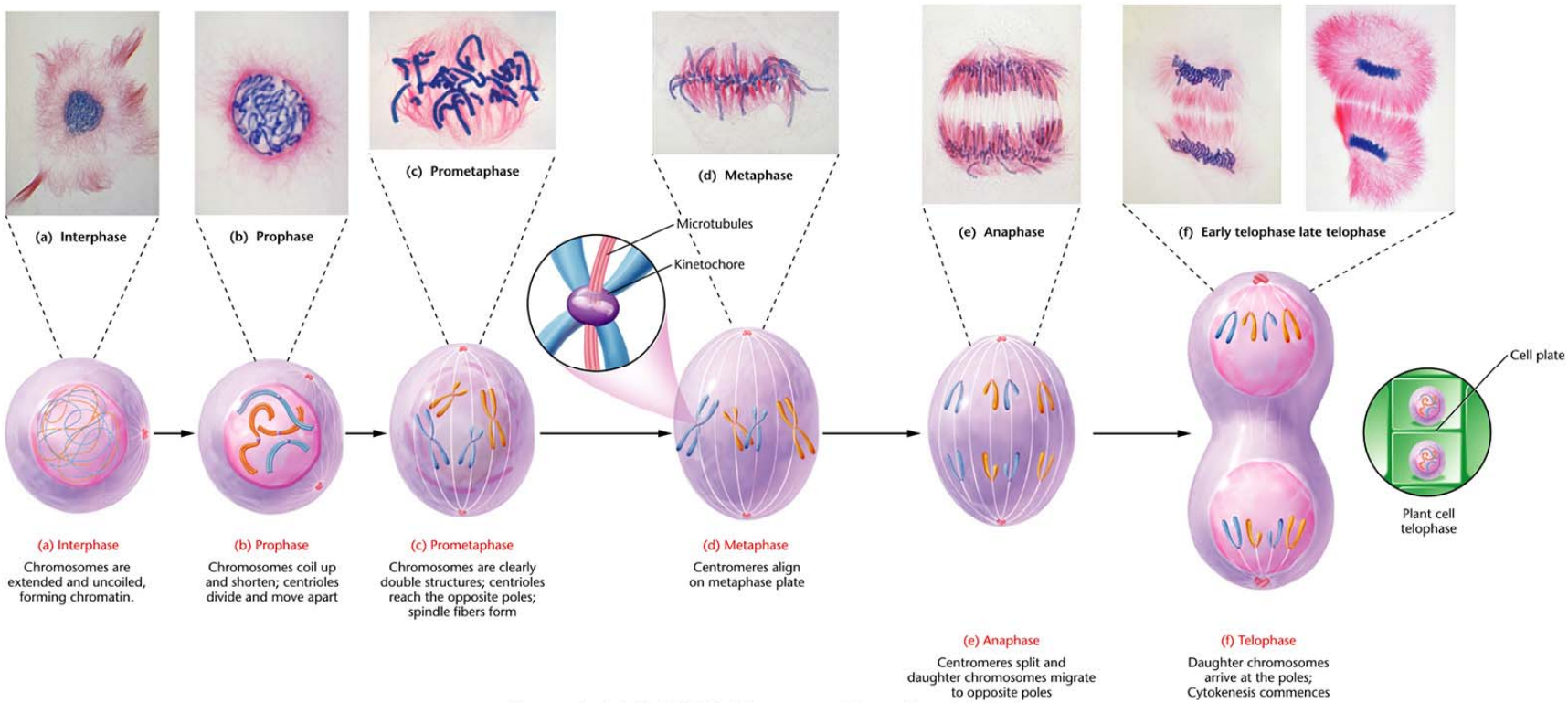
Pro	Met	Ana	Tel
36	3	3	18

Minutes

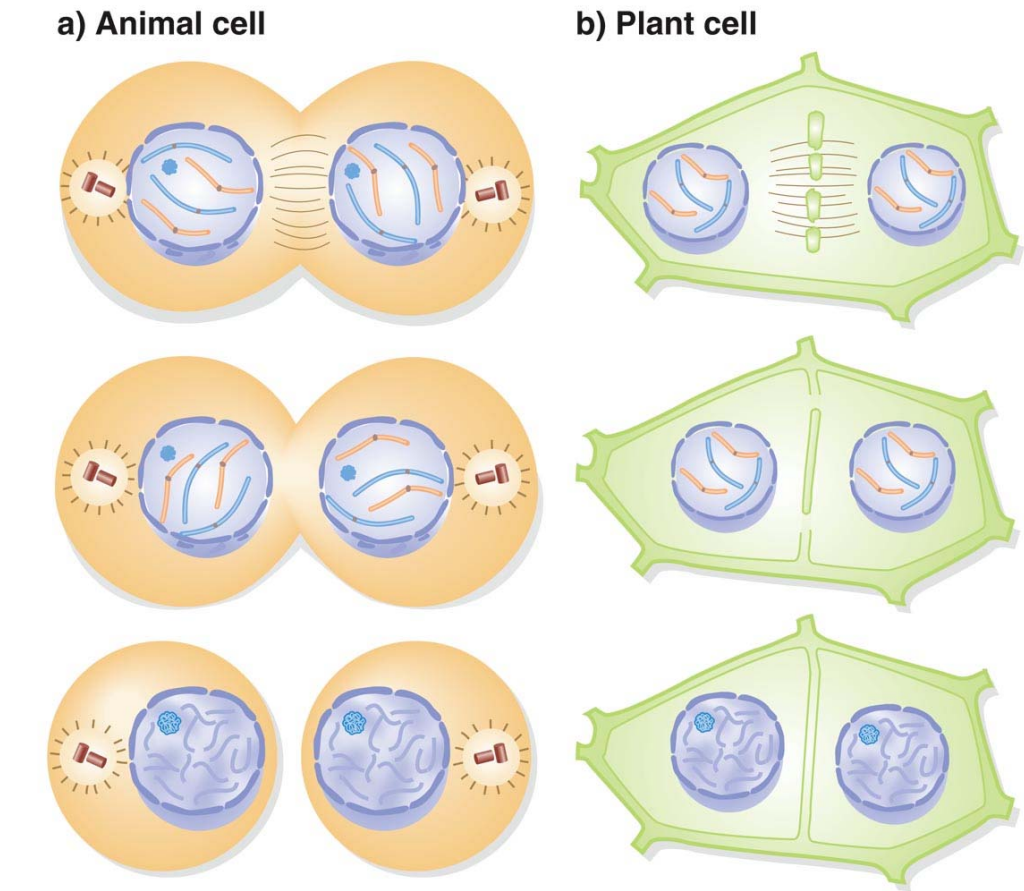
Interphase & Mitosis

- Stages of Mitosis
- Prophase
- Metaphase
- Anaphase
- Telophase
- Cytokinesis
- Results: 2 identical cells

Mitosis



Cytokinesis



Cleavage furrow

Cell plate

Regulation of Cell Cycle

- CDC mutations: 3 checkpoints involved with cyclins
- Cyclin + CDK causes phosphorylation to activate proteins to advance through the cell cycle
- G1/S: cell size, DNA damage, cannot proceed to S
- G2/M: Replication or damage
- M: formation of spindle fiber system, not attached properly
- Tumor suppressor genes: P53 (transcription factor) program cell death or arrest cell cycle, senses DNA damage

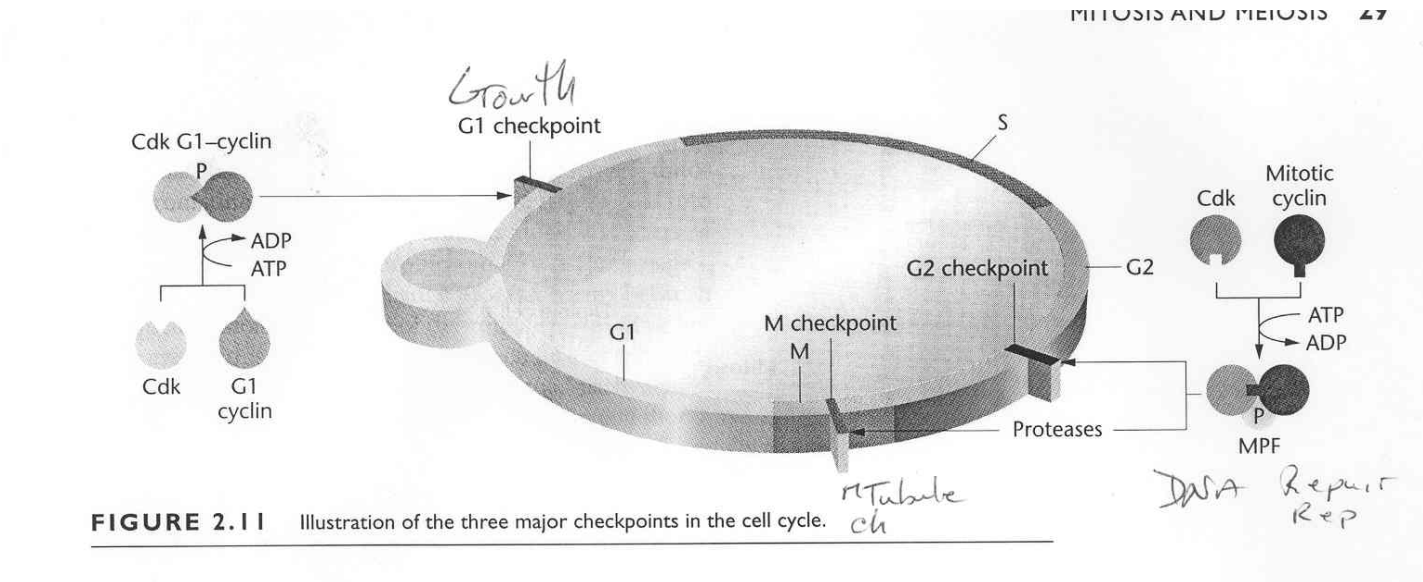


FIGURE 2.11 Illustration of the three major checkpoints in the cell cycle.

Meiosis--Reduction Division

- **Only in diploid cells**
- **Diploid to haploid**
- **Replicate DNA once**
- **2 cell divisions**
- **Production 4 haploid cells**
- **Increase genetic variability**
- **Recombination**
- **Independent assortment of homologues**
- **Non-disjunction**

TABLE 2.1 THE HAPLOID NUMBER OF CHROMOSOMES FOR A VARIETY OF ORGANISMS

Common Name	Scientific Name	Haploid Number	Common Name	Scientific Name	Haploid Number
Black bread mold	*Aspergillus nidulans*	8	House mouse	*Mus musculus*	20
Broad bean	*Vicia faba*	6	Human	*Homo sapiens*	23
Cat	*Felis domesticus*	19	Jimson weed	*Datura stramonium*	12
Cattle	*Bos taurus*	30	Mosquito	*Culex pipiens*	3
Chicken	*Gallus domesticus*	39	Mustard plant	*Arabidopsis thaliana*	5
Chimpanzee	*Pan troglodytes*	24	Pink bread mold	*Neurospora crassa*	7
Corn	*Zea mays*	10	Potato	*Solanum tuberosum*	24
Cotton	*Gossypium hirsutum*	26	Rhesus monkey	*Macaca mulatta*	21
Dog	*Canis familiaris*	39	Roundworm	*Caenorhabditis elegans*	6
Evening primrose	*Oenothera biennis*	7	Silkworm	*Bombyx mori*	28
Frog	*Rana pipiens*	13	Slime mold	*Dictyostelium discoidium*	7
Fruit fly	*Drosophila melanogaster*	4	Snapdragon	*Antirrhinum majus*	8
Garden onion	*Allium cepa*	8	Tobacco	*Nicotiana tabacum*	24
Garden pea	*Pisum sativum*	7	Tomato	*Lycopersicon esculentum*	12
Grasshopper	*Melanoplus differentialis*	12	Water fly	*Nymphaea alba*	80
Green alga	*Chlamydomonas reinhardi*	18	Wheat	*Triticum aestivum*	21
Horse	*Equus caballus*	32	Yeast	*Saccharomyces cerevisiae*	16
House fly	*Musca domestica*	6	Zebrafish	*Danio rerio*	25

Meiosis

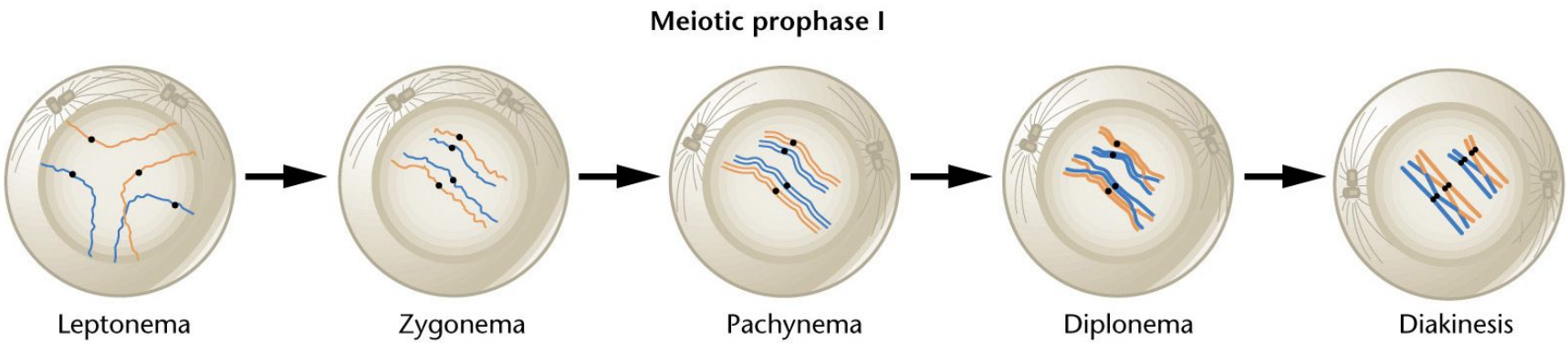
Summary of Meiosis

STAGE	CHARACTERISTICS
Interphase I	Chromosome replication takes place.
Prophase I	Chromosomes become visible, homologous chromosomes pair, and sister chromatids become visible; recombination takes place.
Metaphase I	Paired chromosomes align at equator of cell.
Anaphase I	Homologous chromosomes separate; members of each chromosome pair move to opposite poles.
Telophase I	Cytoplasm divides, producing two cells.
Interphase II	Following a brief pause, chromosomes uncoil slightly; this is not a real interphase as such.
Prophase II	Chromosomes re-coil.
Metaphase II	Unpaired chromosomes become aligned at equator of cell.
Anaphase II	Centromeres split; daughter chromosomes pull apart.
Telophase II	Chromosomes uncoil, nuclear membrane reforms, cytoplasm divides, meiosis is complete.

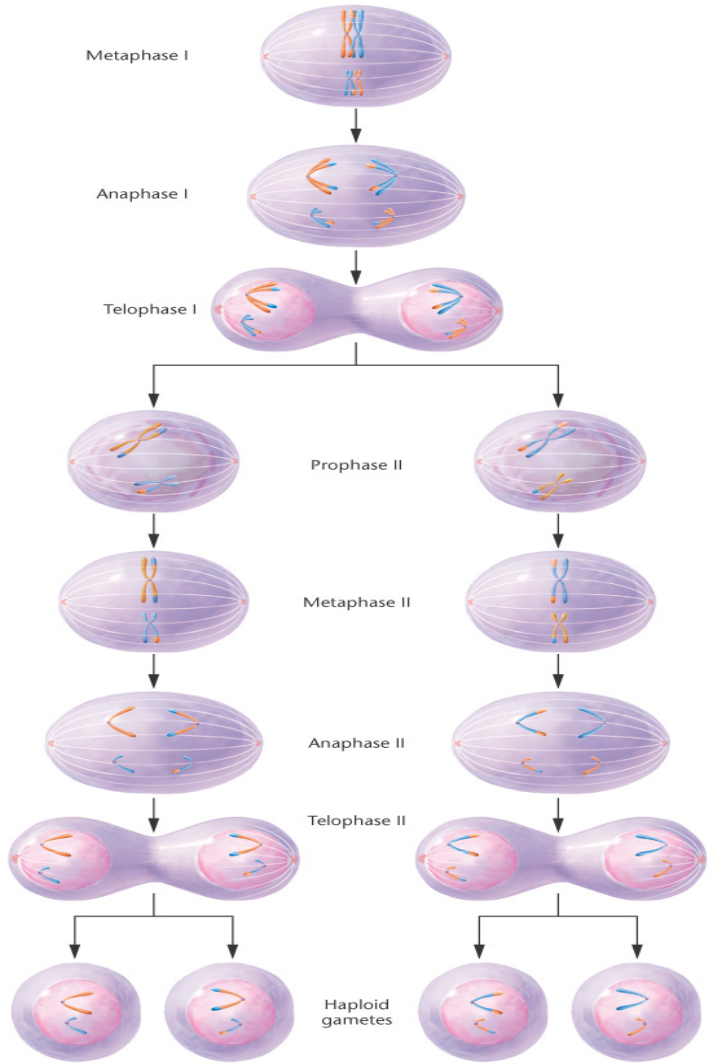
Reductional division

Meiosis--Reduction Division

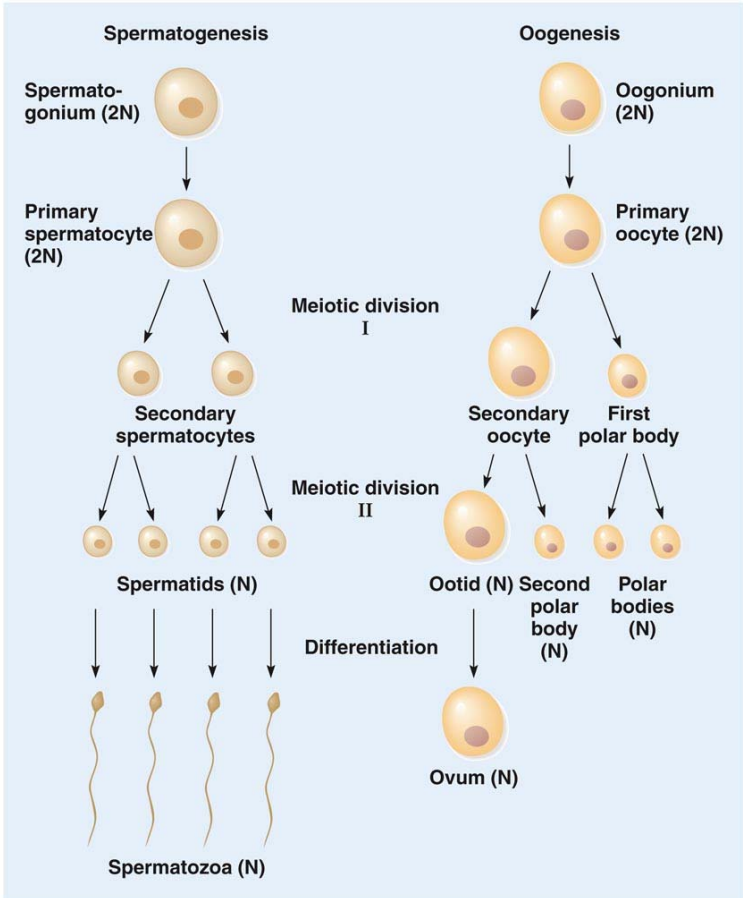
- **Leptonema: condensation of chromatin**
- **Zygonema: homolog search (300nm)**
- **Pachynema: synapsis (100 nm), tetrad stage**
- **Diplonema: chiasma, non-sister chromatids**
- **Diakinesis: pull apart, nucleolus and envelope breakdown, chiasmata move to ends**



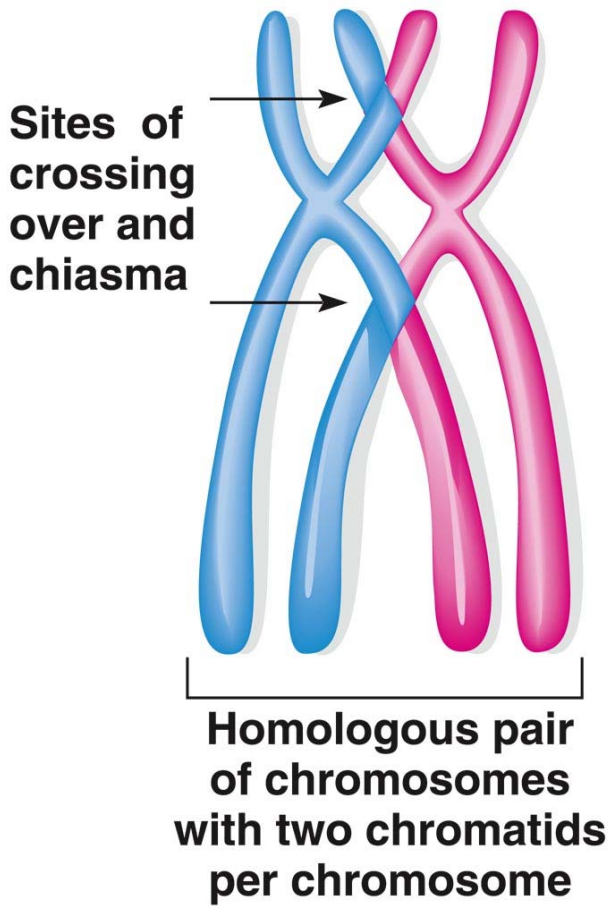
Meiosis--Reduction Division

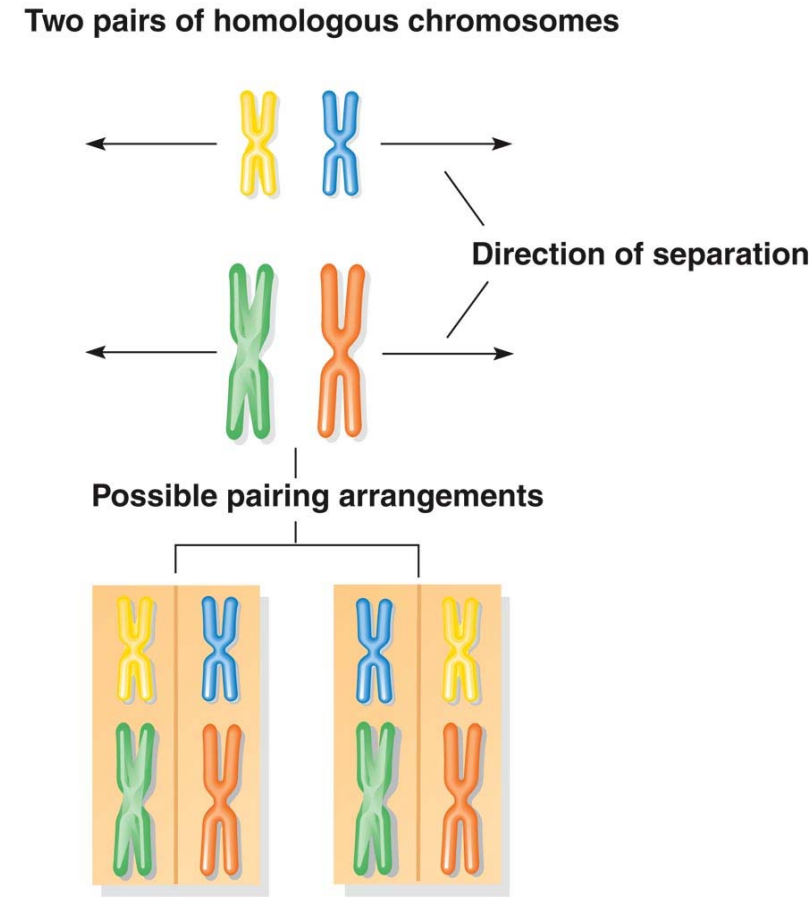


Spermatogenesis & Oogenesis



Genetic Variability





Mitosis vs. Meiosis