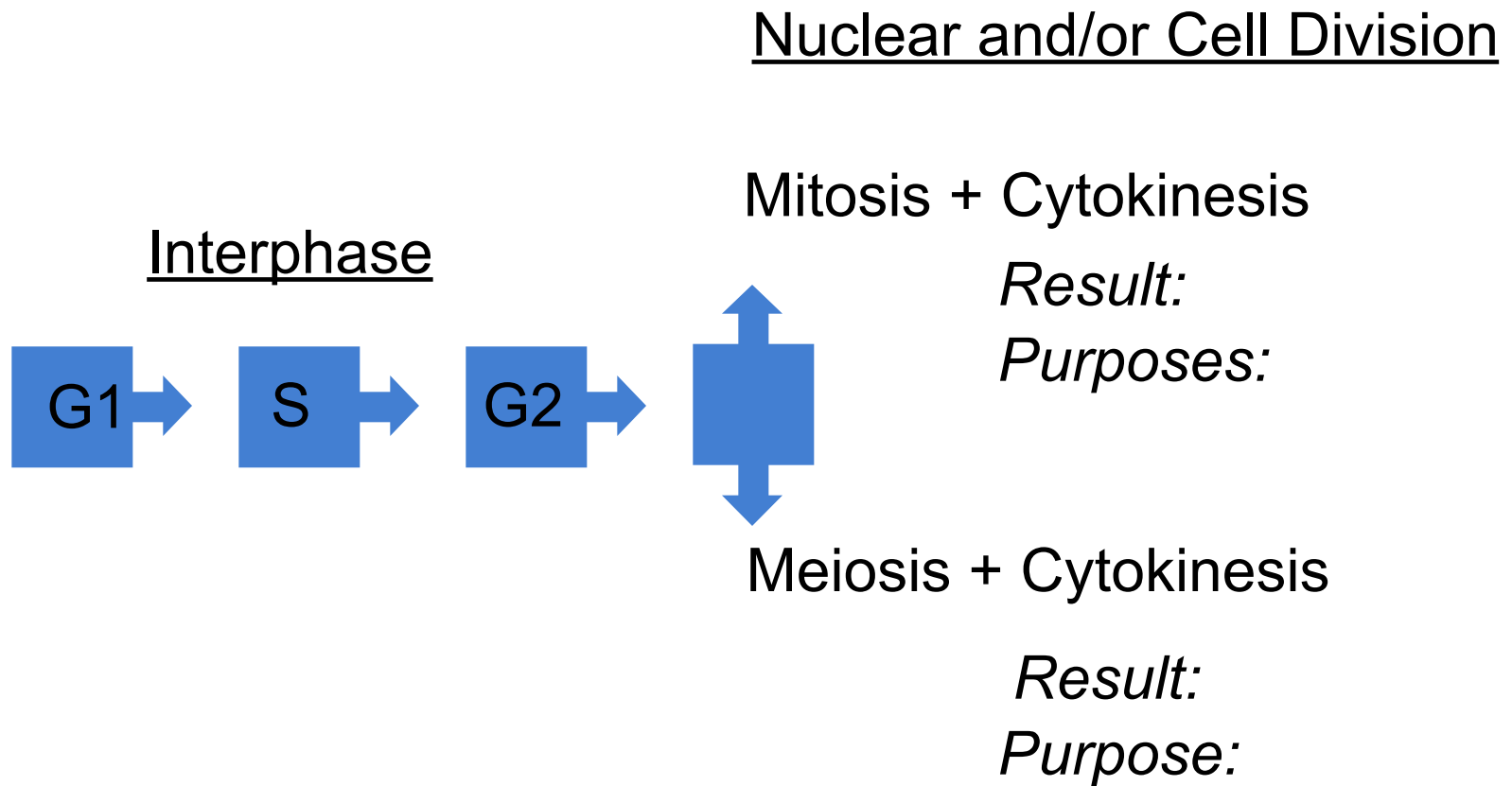


Biology Honors

**Unit: The Cell
Cycle and Cell
Division**

I. Life Cycle of a Cell

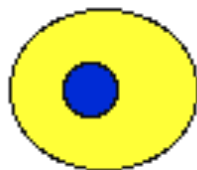


S Phase: Synthesis phase.
DNA is replicated here.

G2 Phase: Second gap phase.
Preparation for mitosis

Chromosomes have two strands of DNA

Parent cell



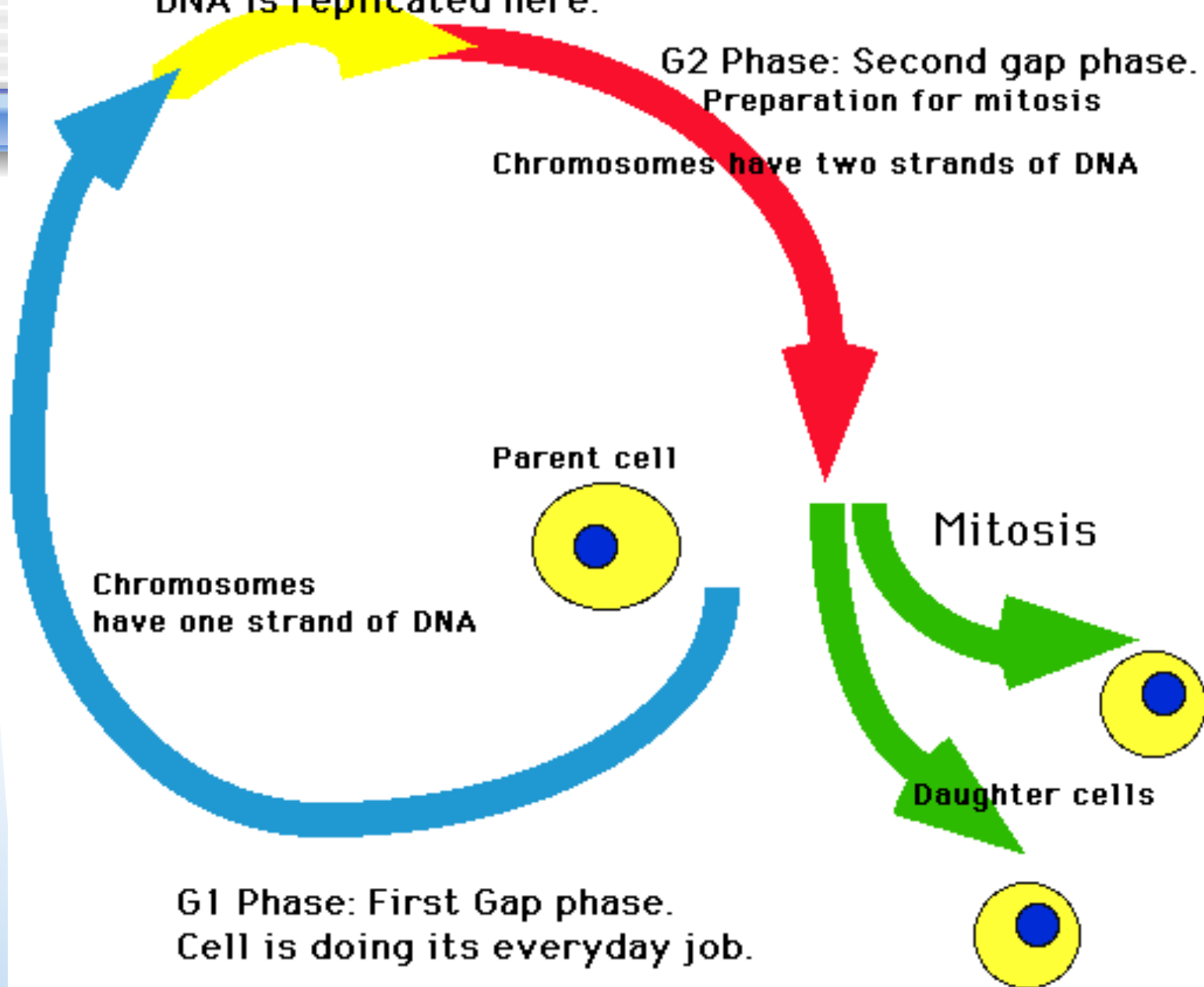
Chromosomes
have one strand of DNA

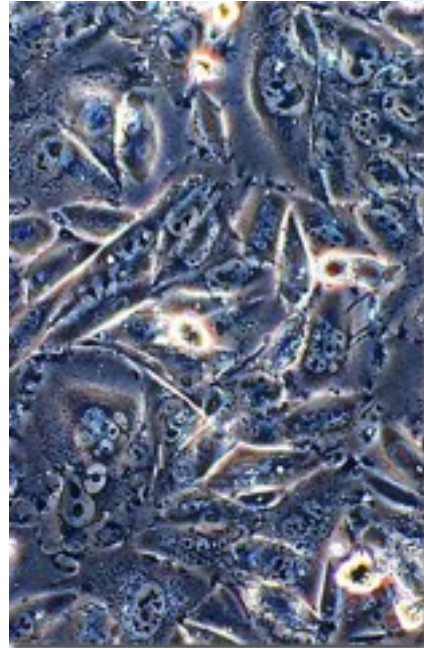
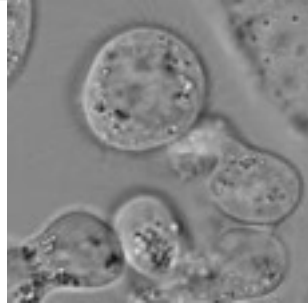
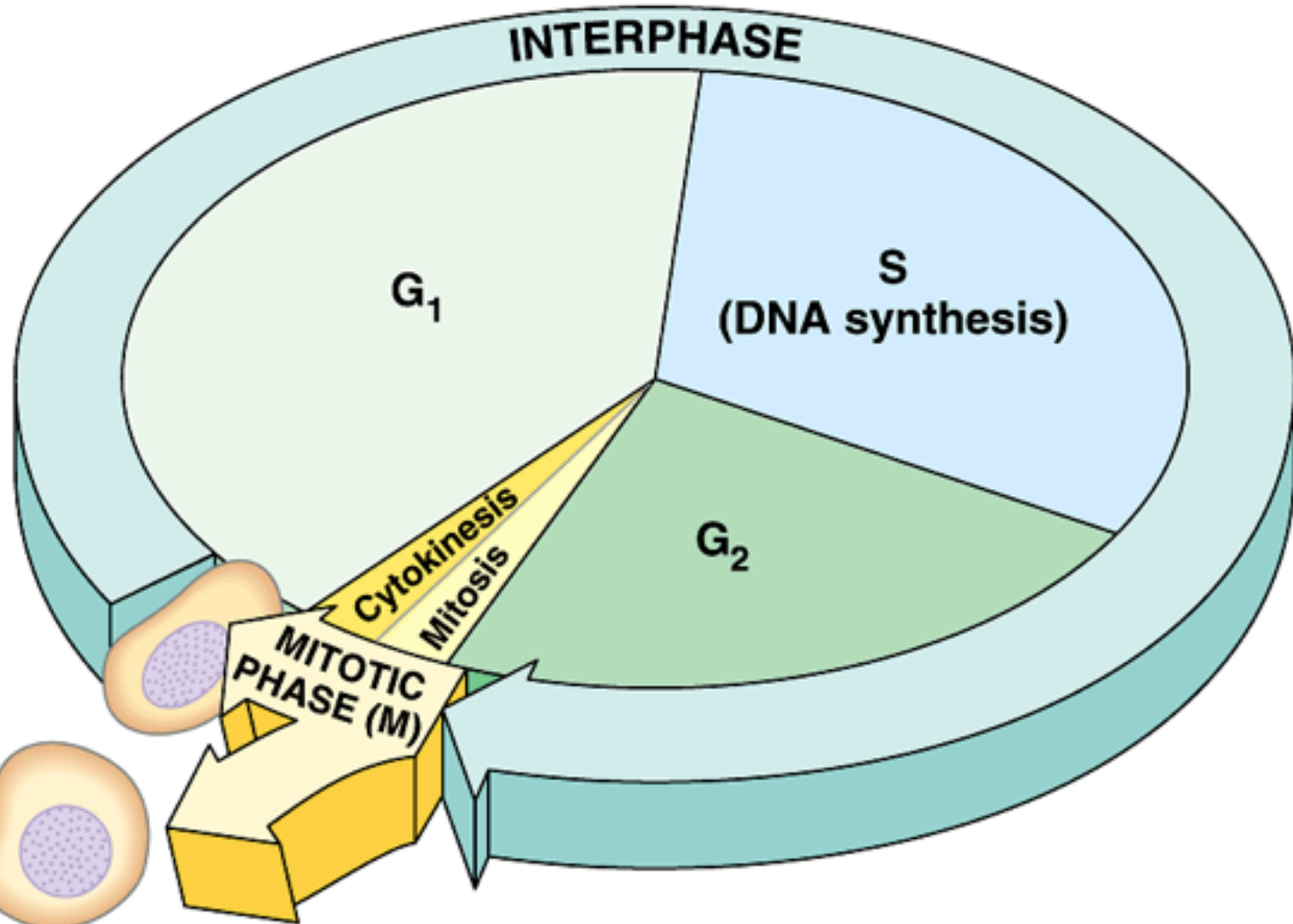
Mitosis

Daughter cells



G1 Phase: First Gap phase.
Cell is doing its everyday job.





Mitosis in Rat Kangaroo Epithelial Kidney Cells

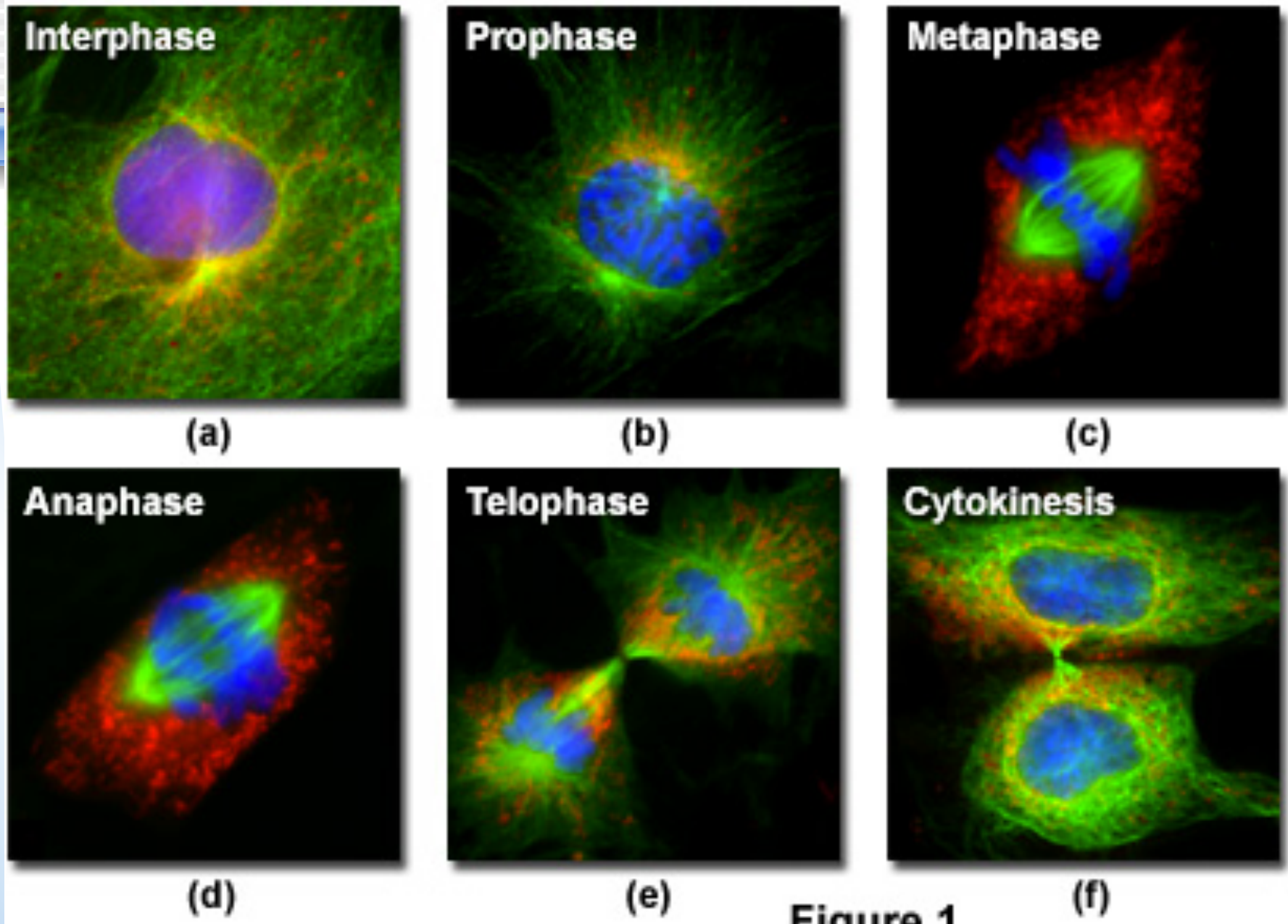
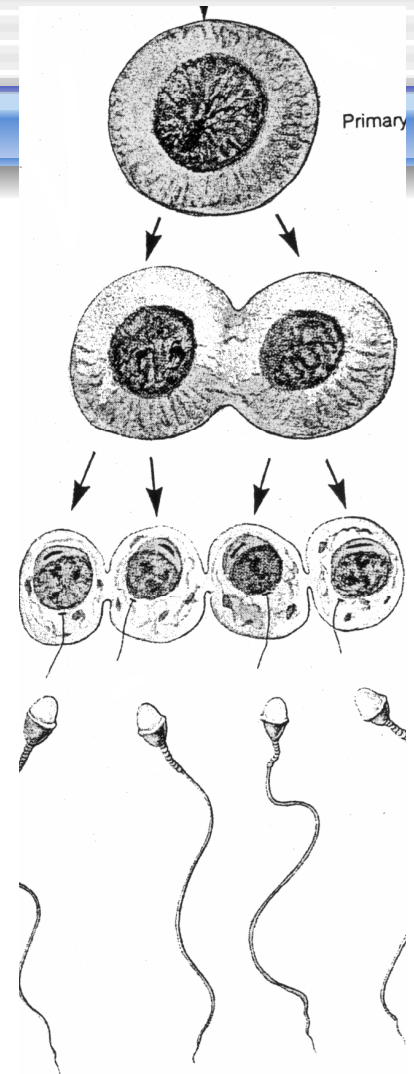
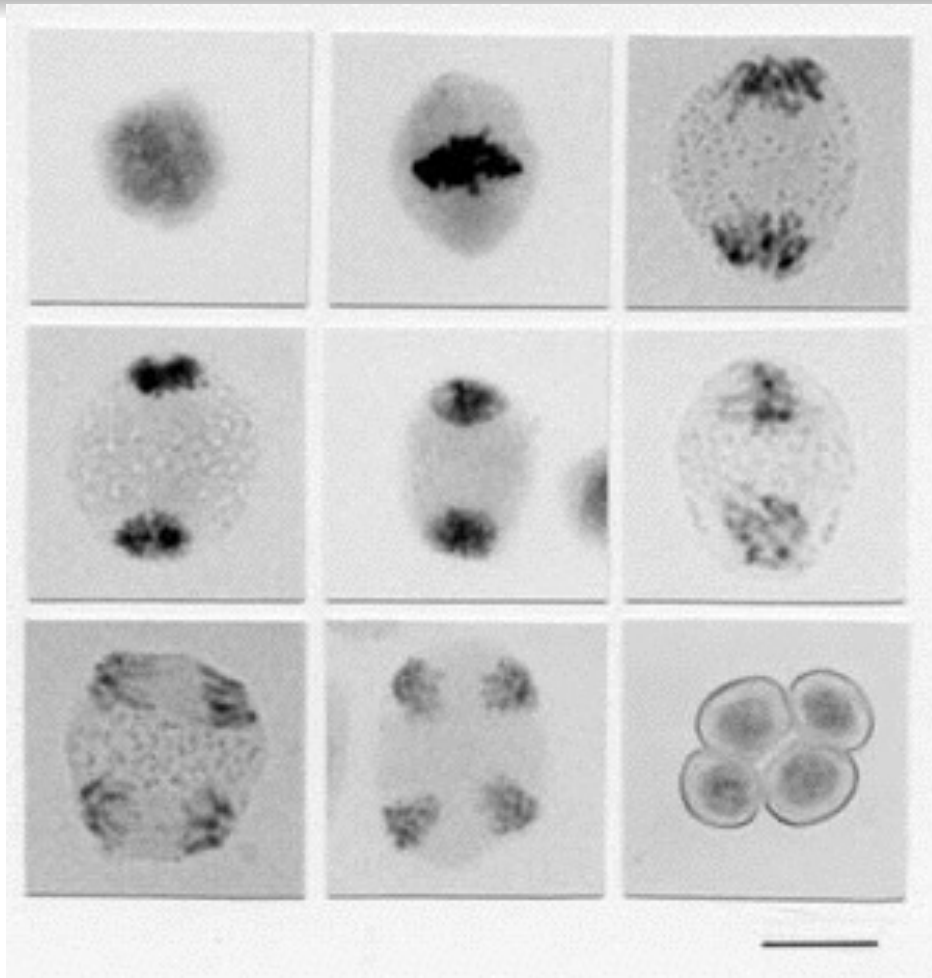


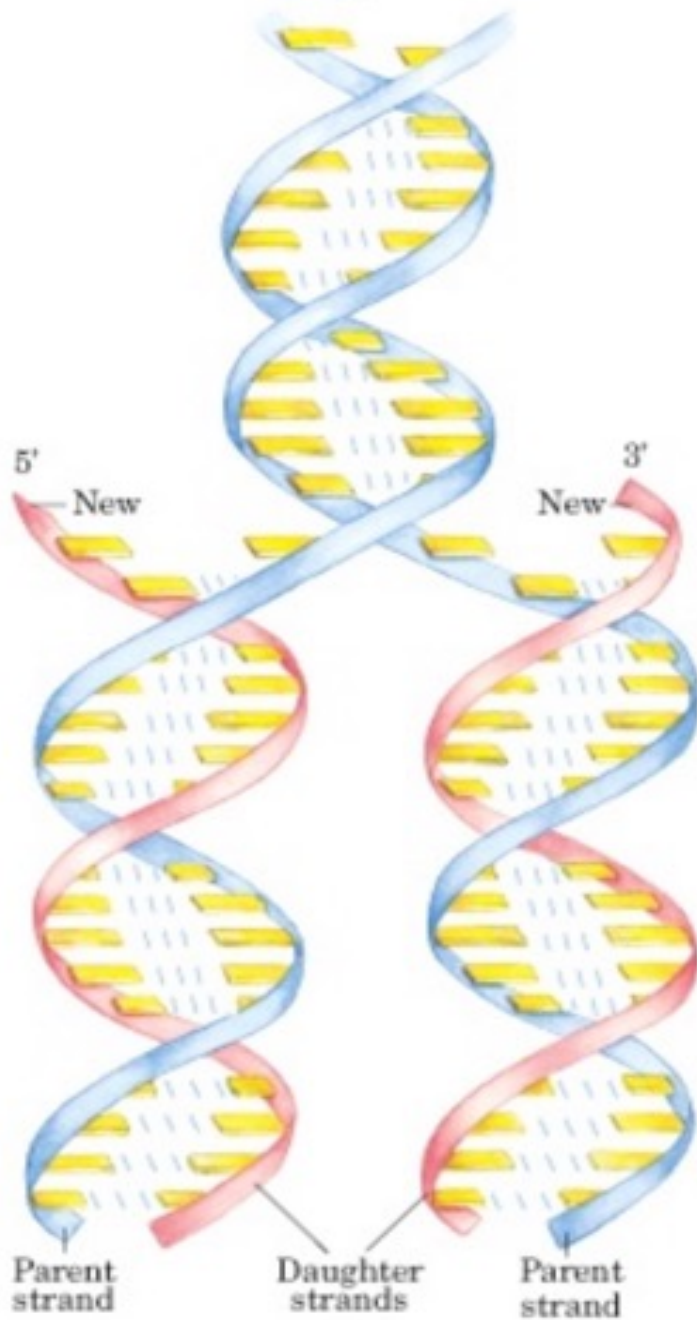
Figure 1



II. DNA Replication

- Occurs during S-phase of Interphase
- Uses enzymes– Helicase, DNA polymerase, DNA ligase
- Described as **semi-conservative**

DNA Replications

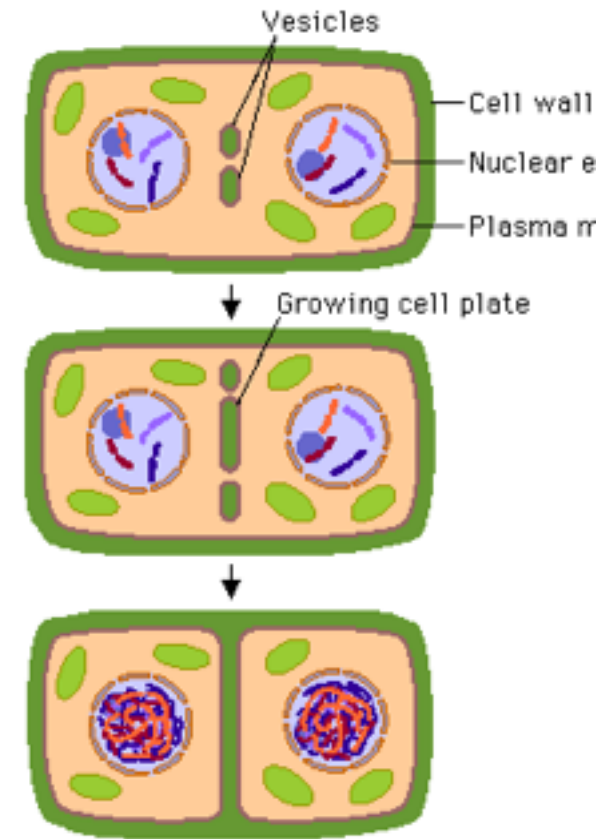




- Mitosis and Cytokinesis in both animal and plant cells

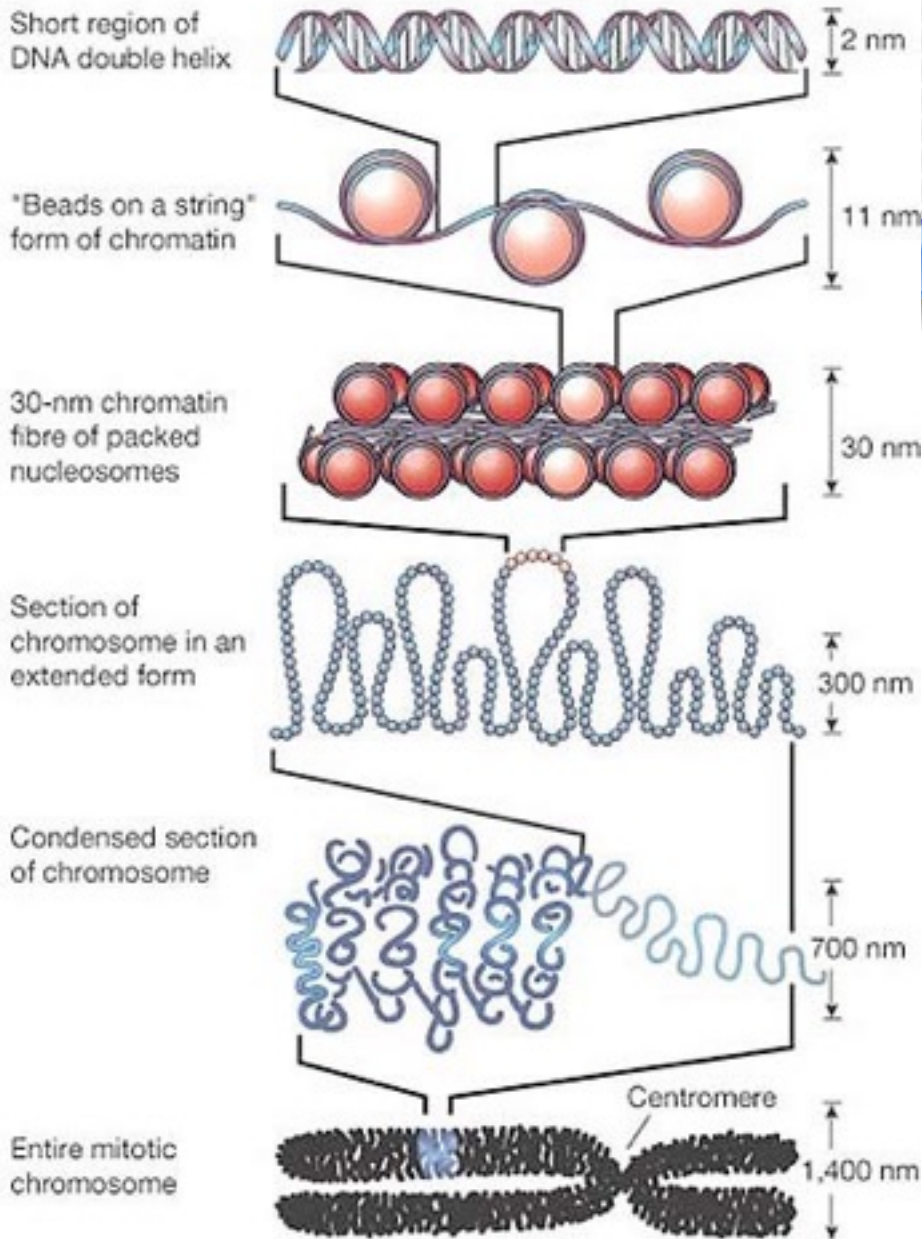
- Cytokinesis in Animals
 - Contractile Ring formation

- Cytokinesis in Plants
 - Cell Plate Forms

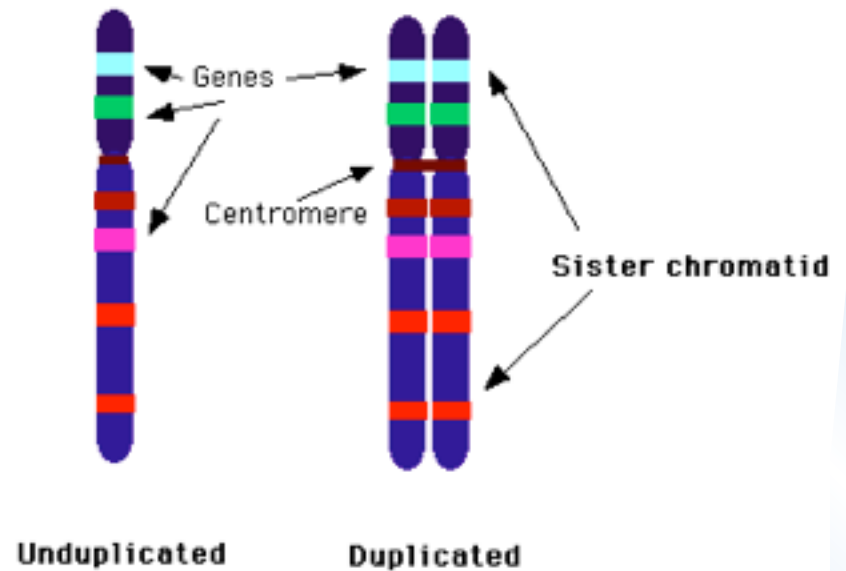


III. Chromosome Number

- Chromosome = DNA molecule
- Chromosomes with 1 DNA = **unduplicated**
- Chromosomes with 2 DNA = **duplicated **
- Each species has a unique number of
- chromosomes (= n)
- Pairs of chromosomes are called called **homologues**



Chromosome Terminology



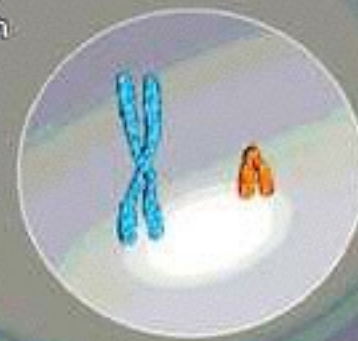
Diploid (2n)

2 copies of each chromosome

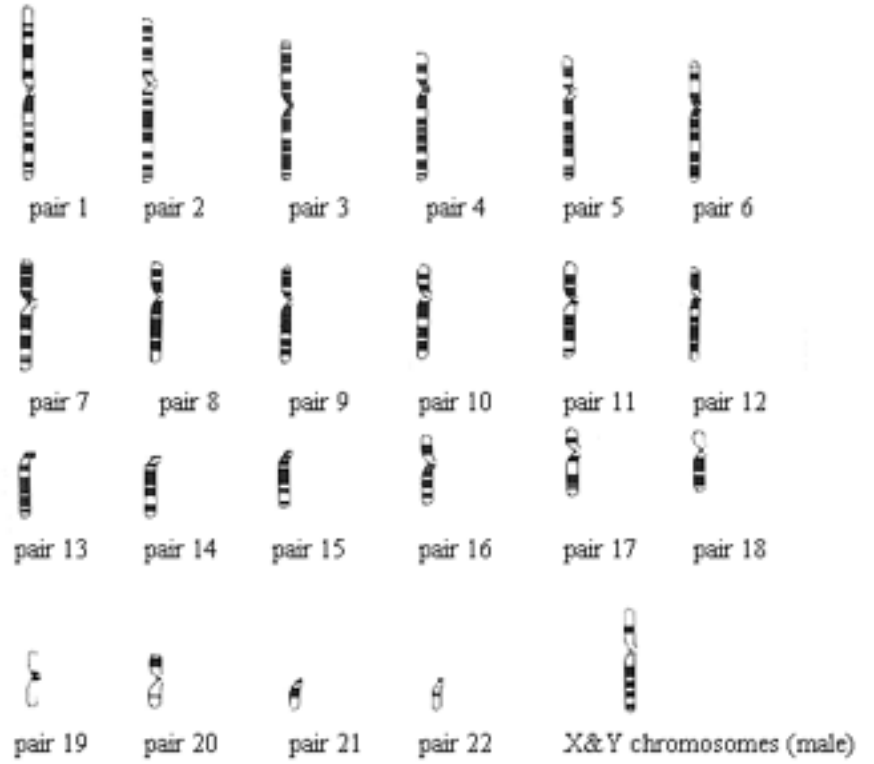


Haploid (n)

one copy of each chromosome

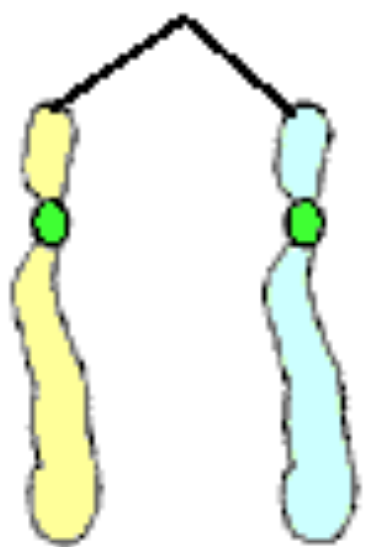


mouse



human

Chromatids



● Centromere

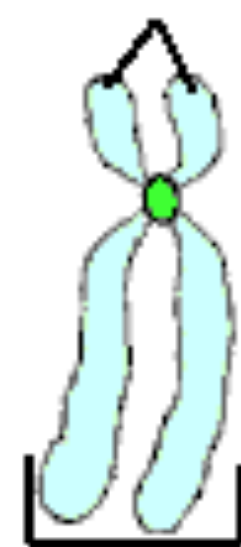
REPLICATION



Sister-chromatids



Sister-chromatids



Homolog chromosomes

Common Name	Species	Diploid number	Common Name	Species	Diploid number
Animals (2n)			Plants (2n)		
Human	<i>Homo sapiens</i>	46	Corn	<i>Zea mays</i>	20
Monkey	<i>Macaca mulatta</i>	42	Potato	<i>S. tuberosum</i>	48
Dog	<i>Canis familiaris</i>	78	Green algae	<i>A. mediterranea</i>	20
Cat	<i>Felis domesticus</i>	38			
Mouse	<i>Mus musculus</i>	40	Fungi (2n)		
Frog	<i>Rana pipiens</i>	26	Yeast	<i>S. cerevisiae</i>	32
Fruit fly	<i>Drosophila melanogaster</i>	8	Fungi (1n)		Haploid number
Flatworm	<i>Planaria torva</i>	16	Mold	<i>Penicillium species</i>	4

IV. Mitosis vs. Meiosis

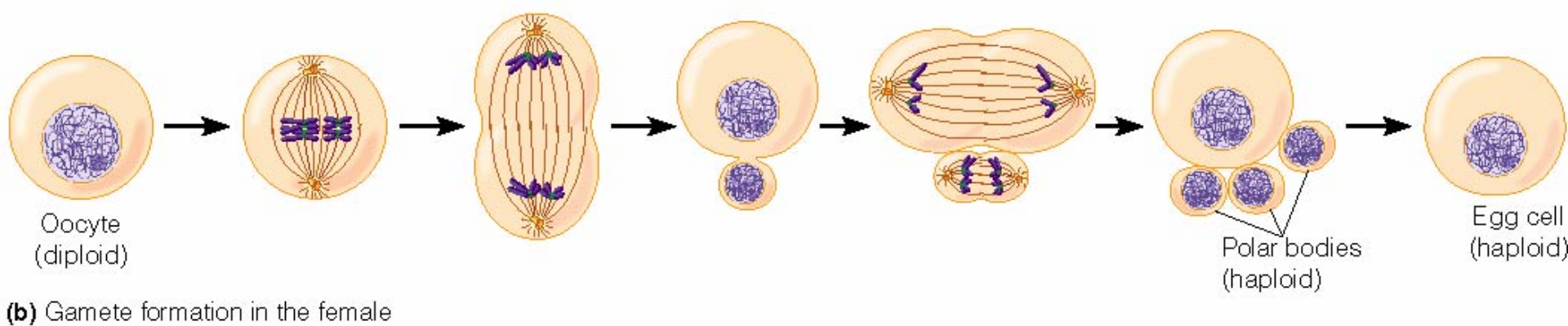
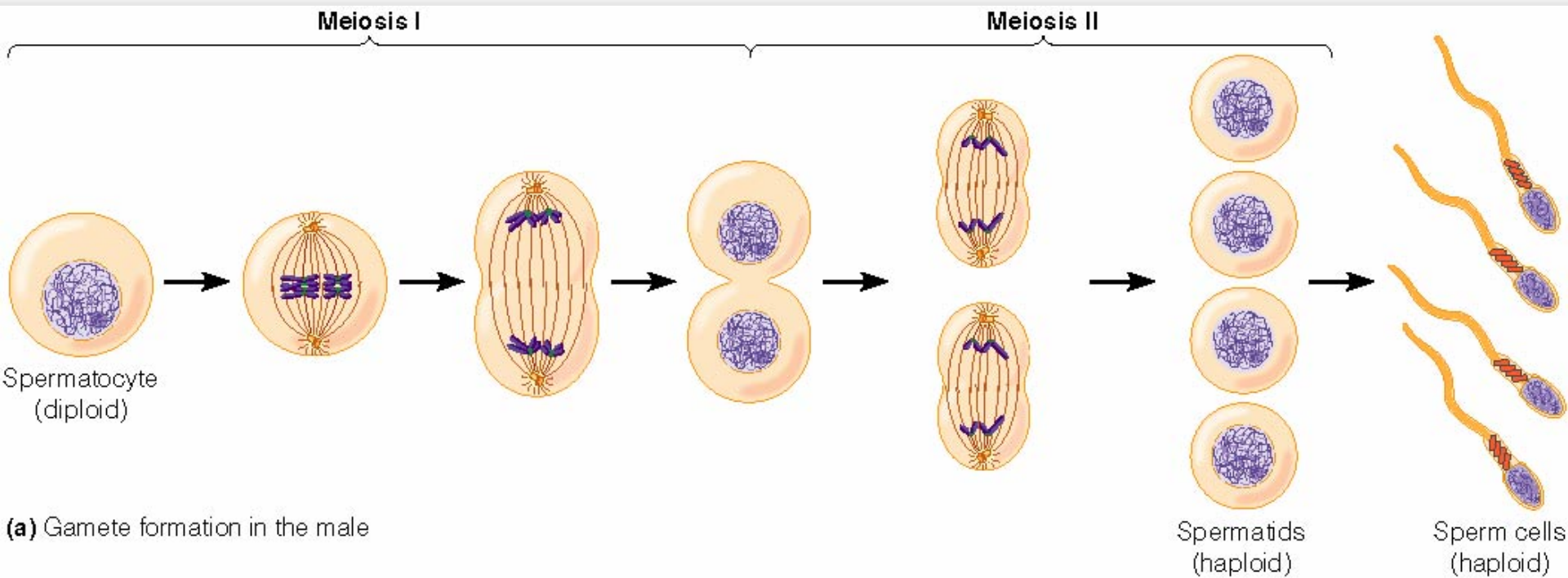
Mitosis	Meiosis
Asexual reproduction/ Growth/Repair	Sexual reproduction
$2n \rightarrow 2n$; $n \rightarrow n$	$2n \rightarrow n$
1 cell division	2 cell divisions
2 cells formed	4 cells formed
clones	Gametes with genetic variation due to 1) crossing-over and 2) random alignment

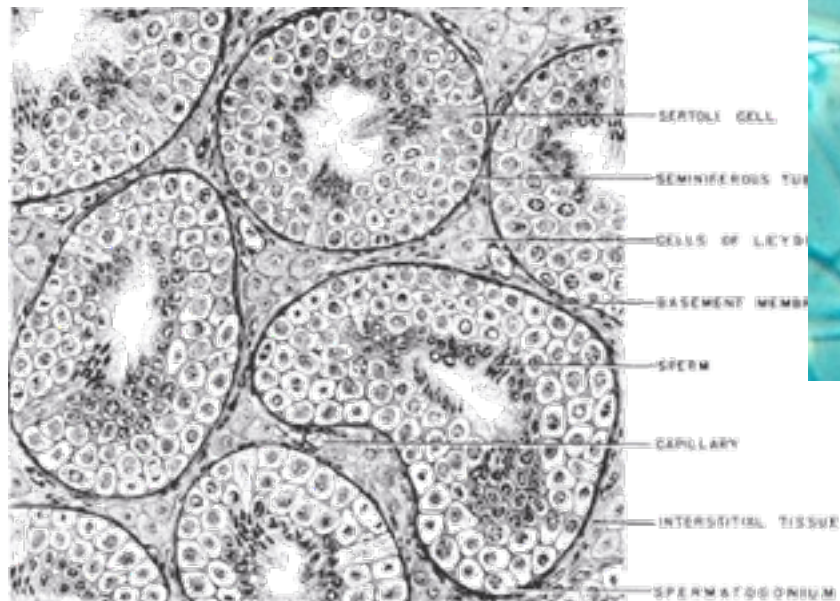
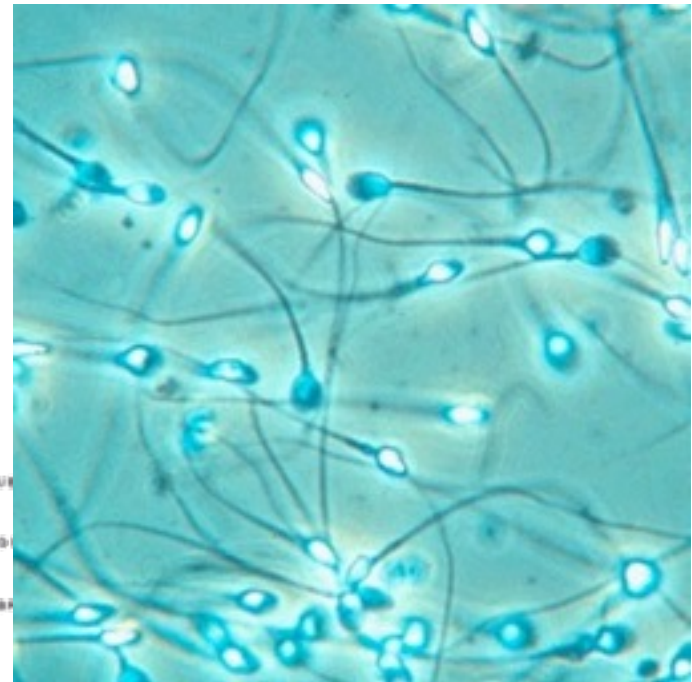
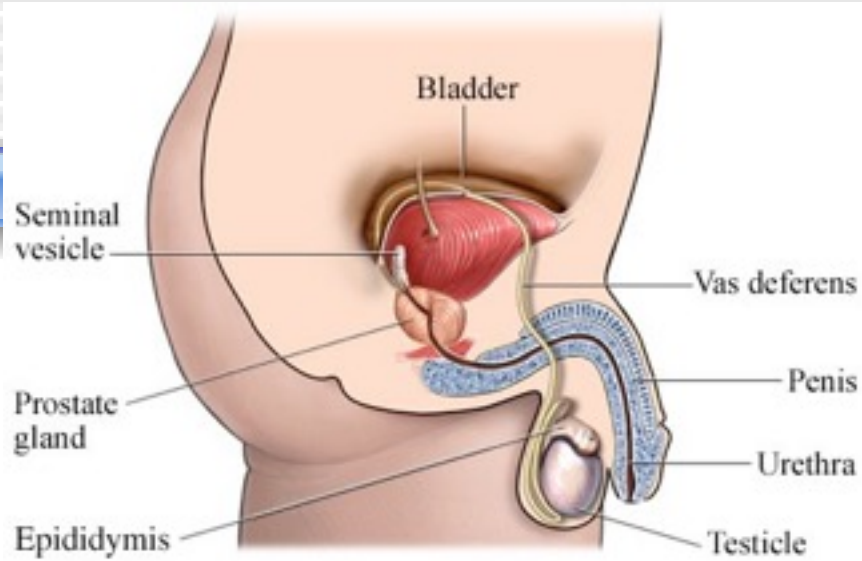
V. Meiosis in Animals

- Spermatogenesis– formation of four functional sperm, occurs in testes
- Oogenesis– formation of one functional ovum (egg) and 3 polar bodies, occurs in ovaries

Sexual Reproduction Creates Varied Offspring

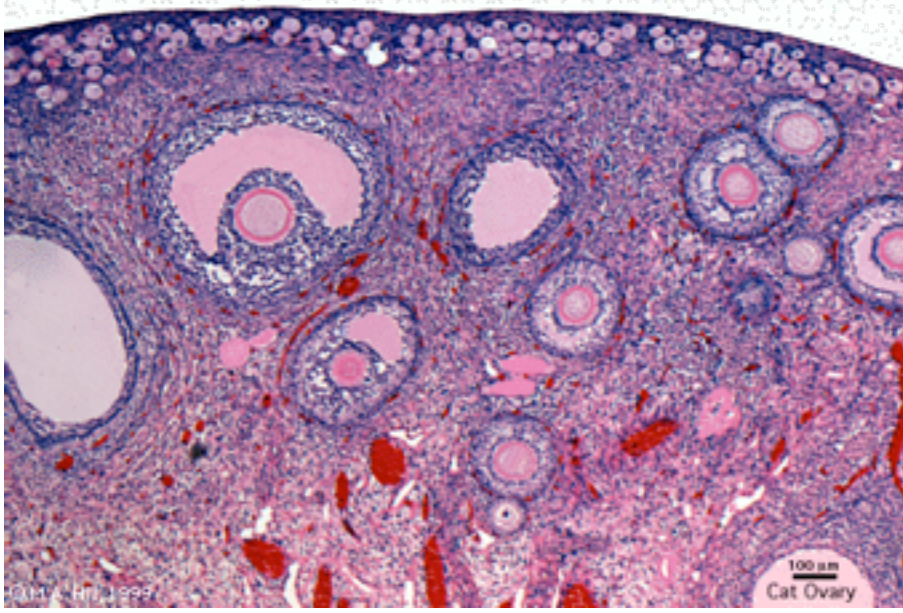
- The Diversity of sexually reproduced organisms is caused by two events in Prophase I of meiosis:
 - ◆ Random Alignment
 - ◆ Crossing Over







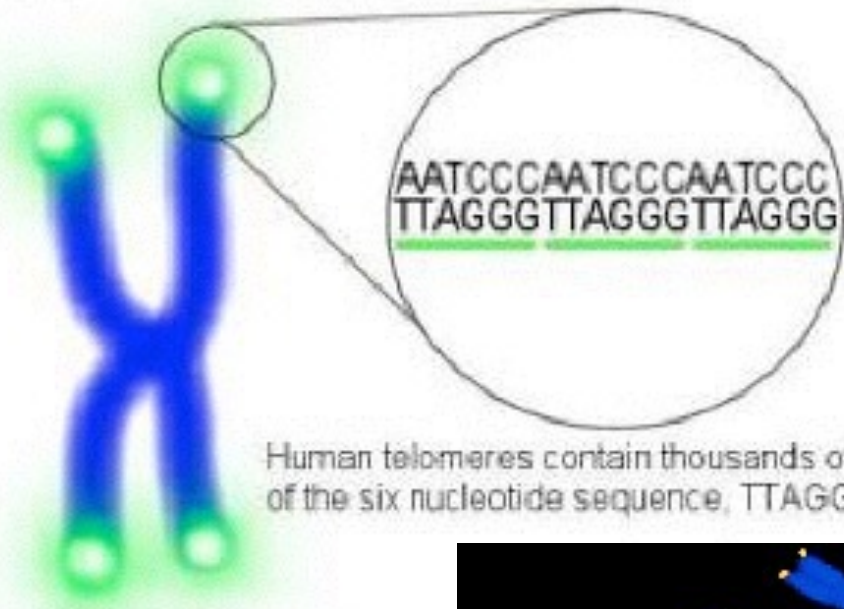
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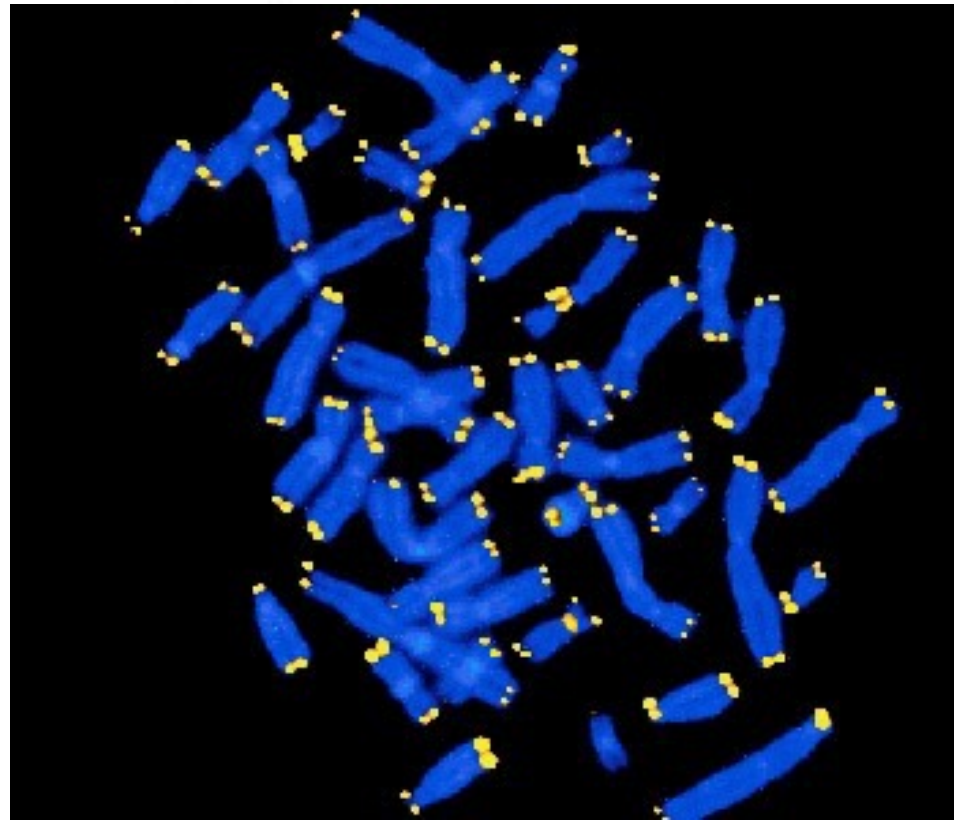


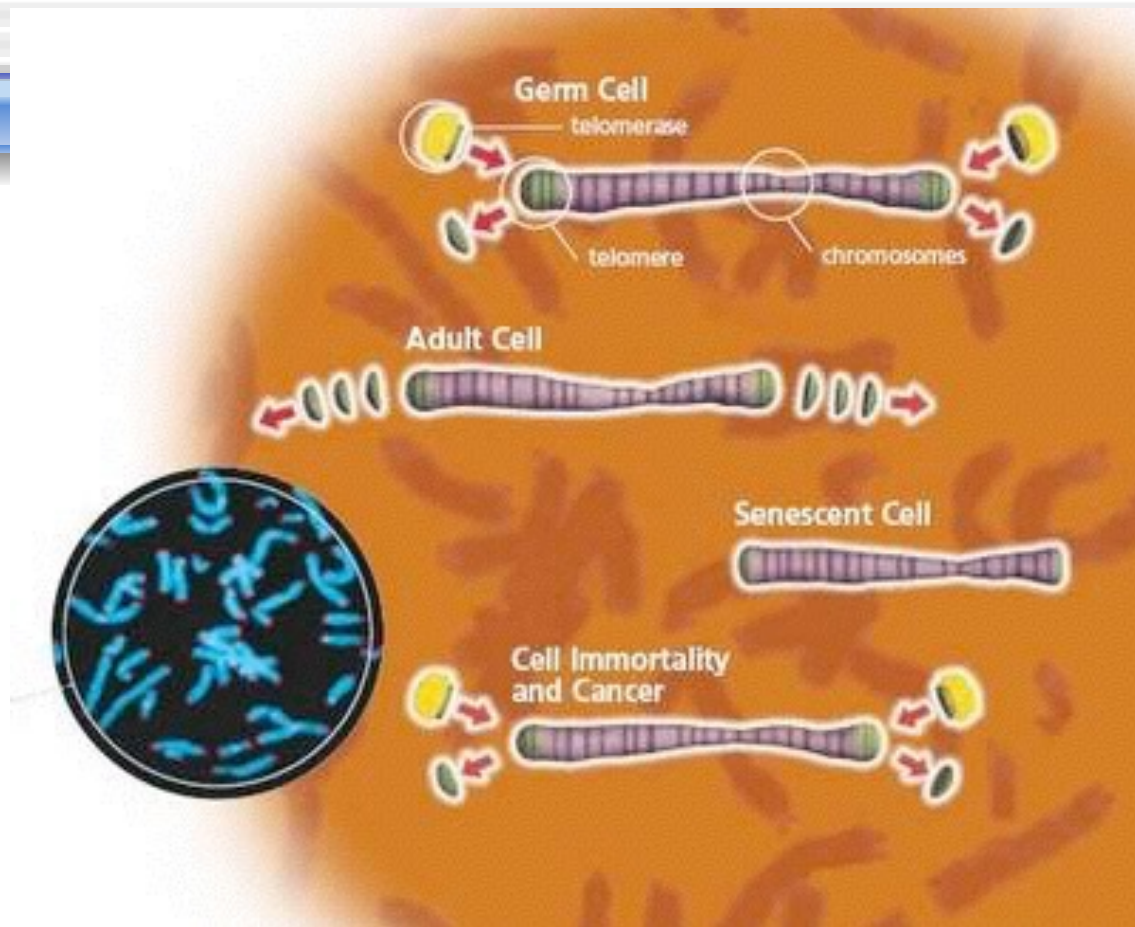
VII. Cell Aging

- Length of a cell line is determined by the number of telomeres
- Telomeres are repeated sequences of DNA at the ends of chromosomes
- Telomerase adds telomeres
- Telomerase is active in oogenesis and spermatogenesis, unicellular organisms, specialized areas in plants, and some cancers



Human telomeres contain thousands of repeats of the six nucleotide sequence, TTAGGG

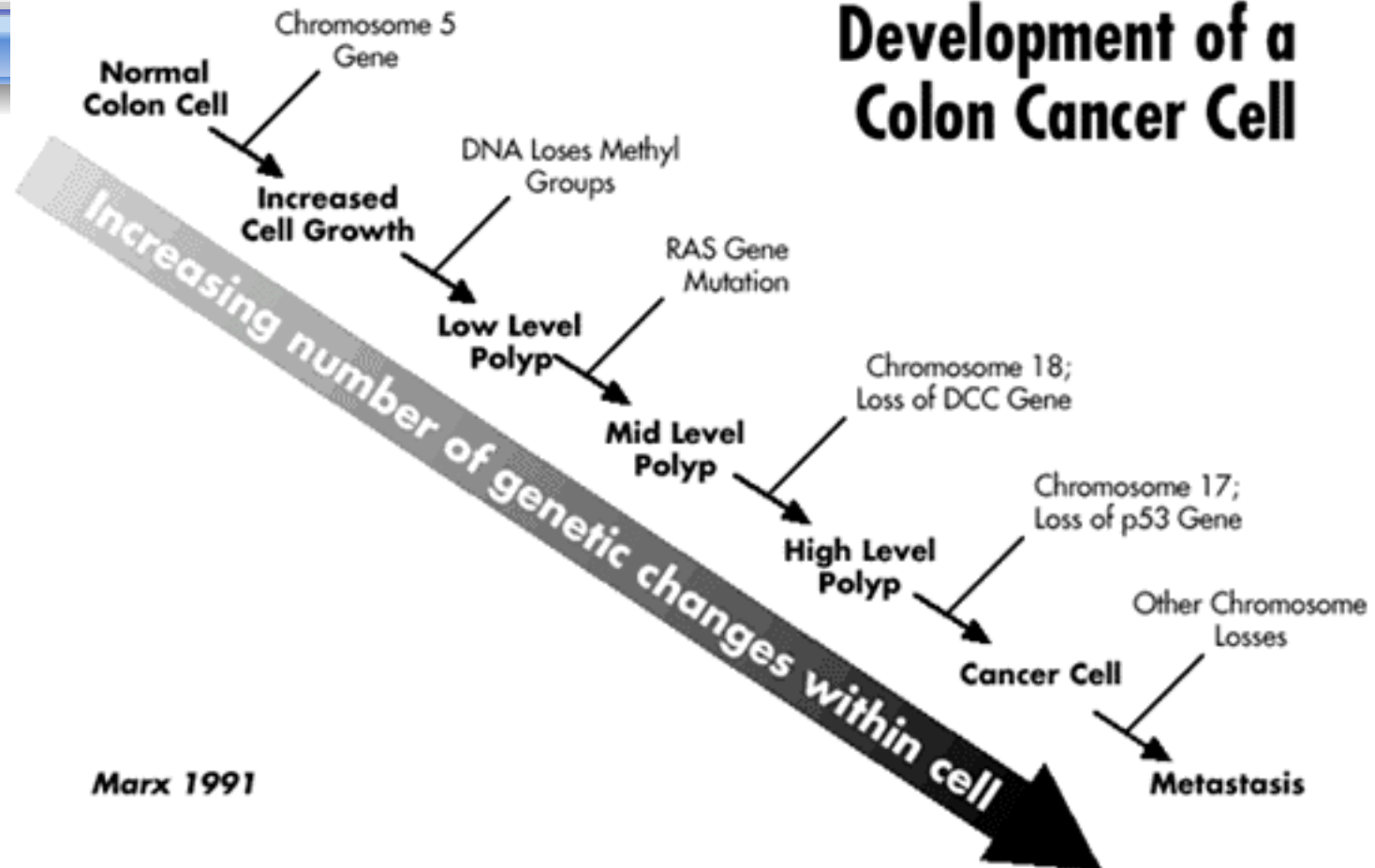




VIII. Cancer

- 2 types of genes control cell cycle
- Oncogenes– code for proteins that stimulate cell division
- Anti-oncogenes– code for proteins that are cell division inhibitors, also known as tumor-suppressor genes.

Development of a Colon Cancer Cell



Marx 1991

