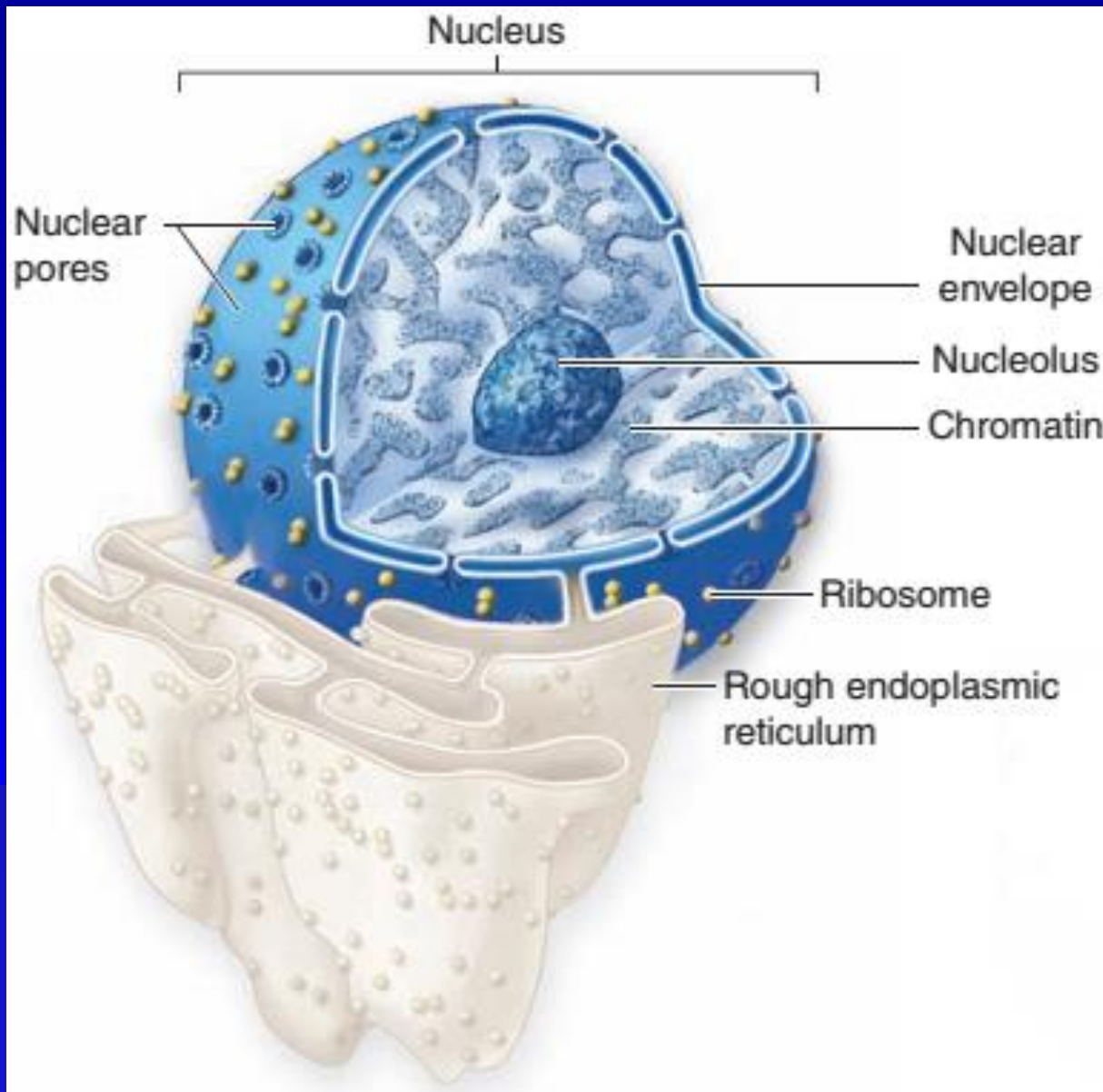


Cell nucleus

Chromatin

Chromosomes

Karyotype

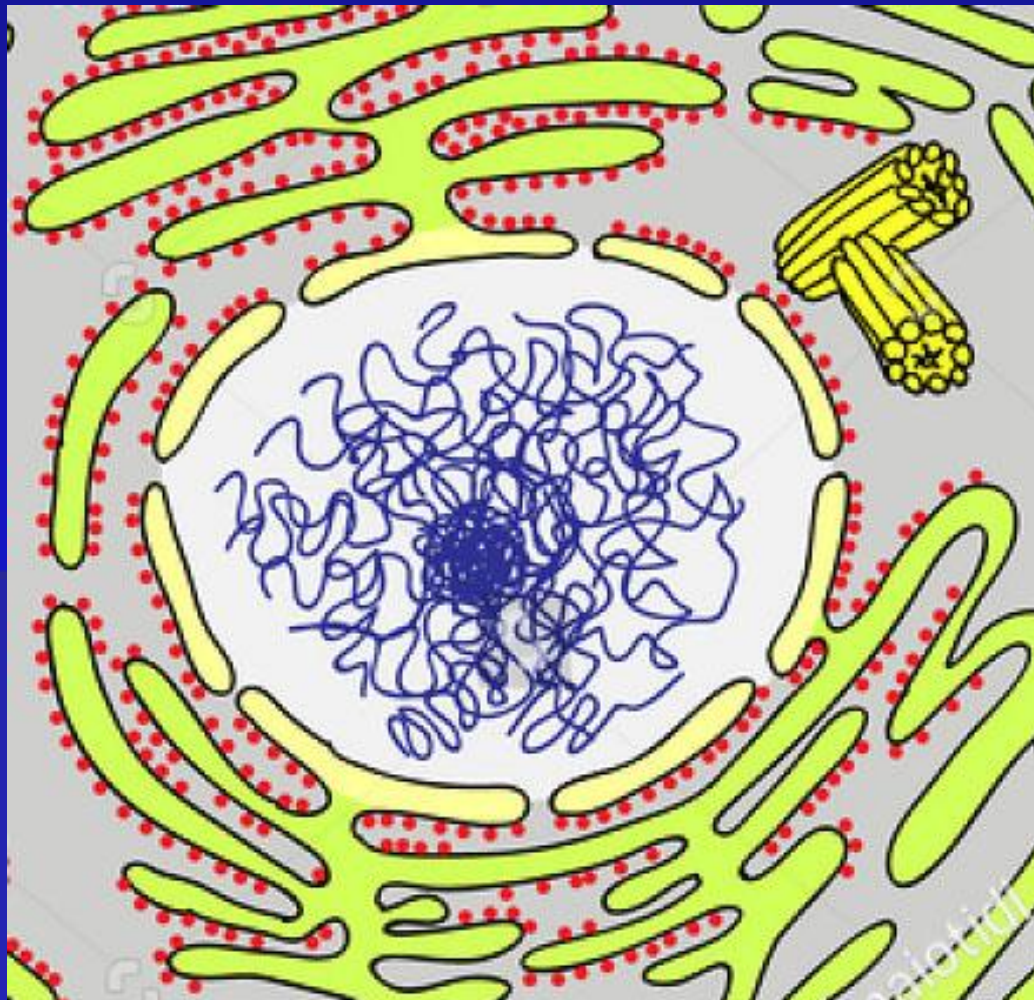


Largest and the most prominent organelle in a cell

Nucleolus - the largest structure in the nucleus; contains genes for rRNA; the site of ribosome biogenesis.

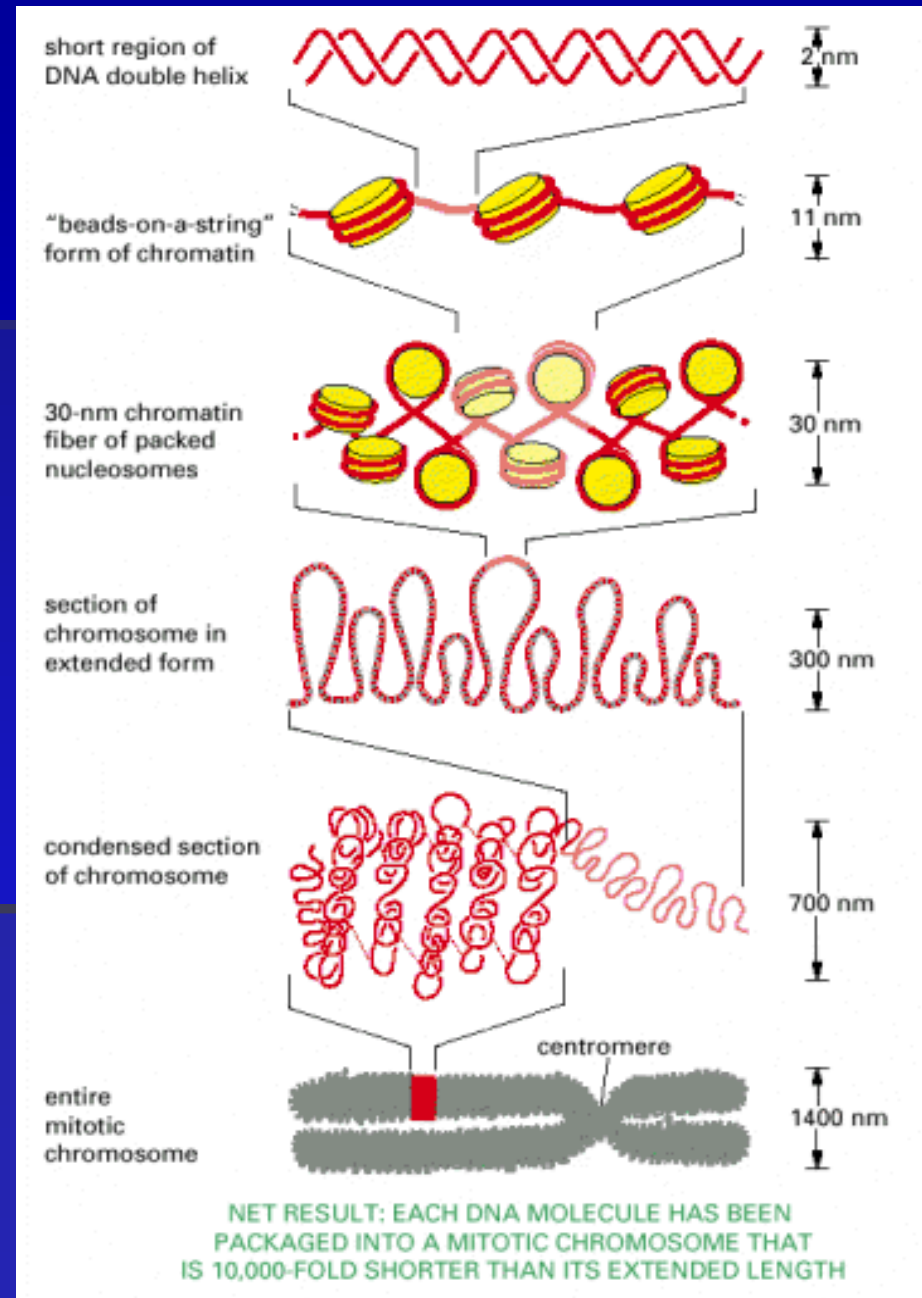
Nuclear envelope consists of two lipid bilayer membranes, an inner nuclear membrane, and an outer nuclear membrane.

The outer nuclear membrane is continuous with the endoplasmic reticulum membrane. The nuclear envelope has many nuclear pores that allow materials to move between the cytosol and the nucleus.



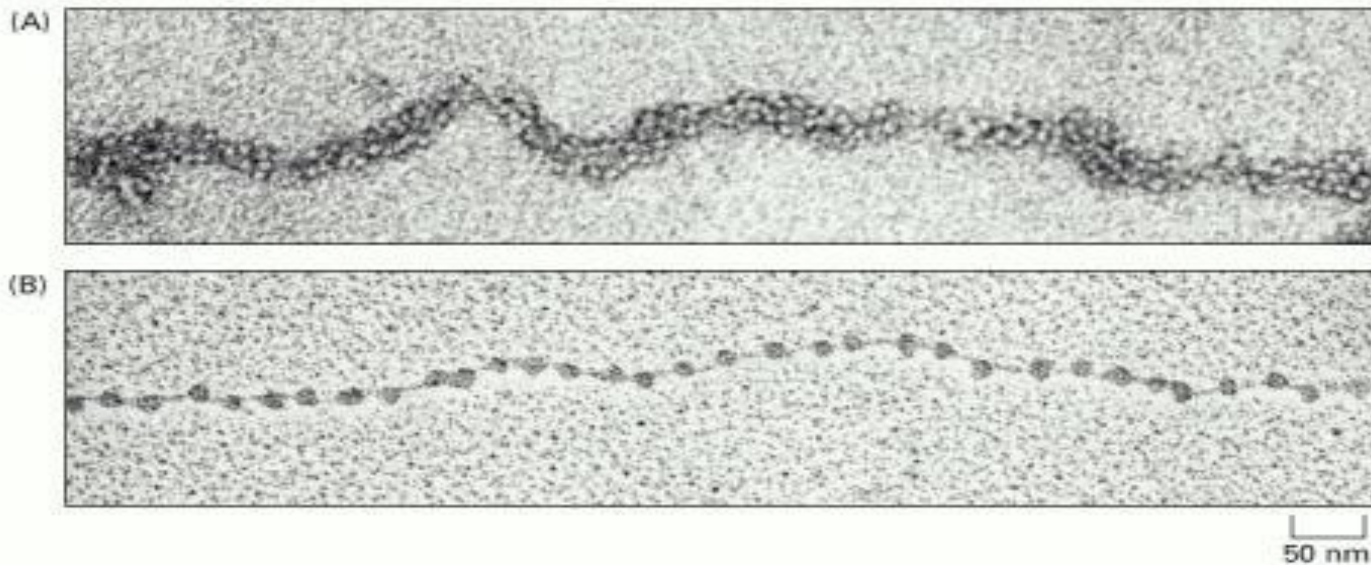
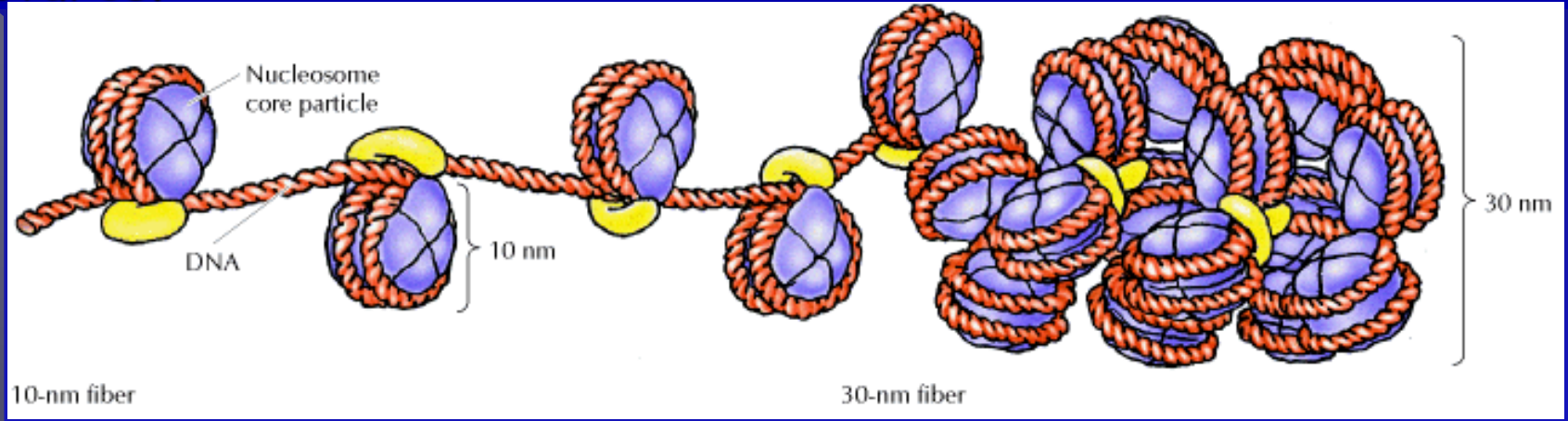
DNA is condensed in chromosomes

- Interphase - 1000-fold compaction
- Metaphase - 10 000-fold compaction
- Nucleosomes
- Chromosome parts
- Sister chromatids

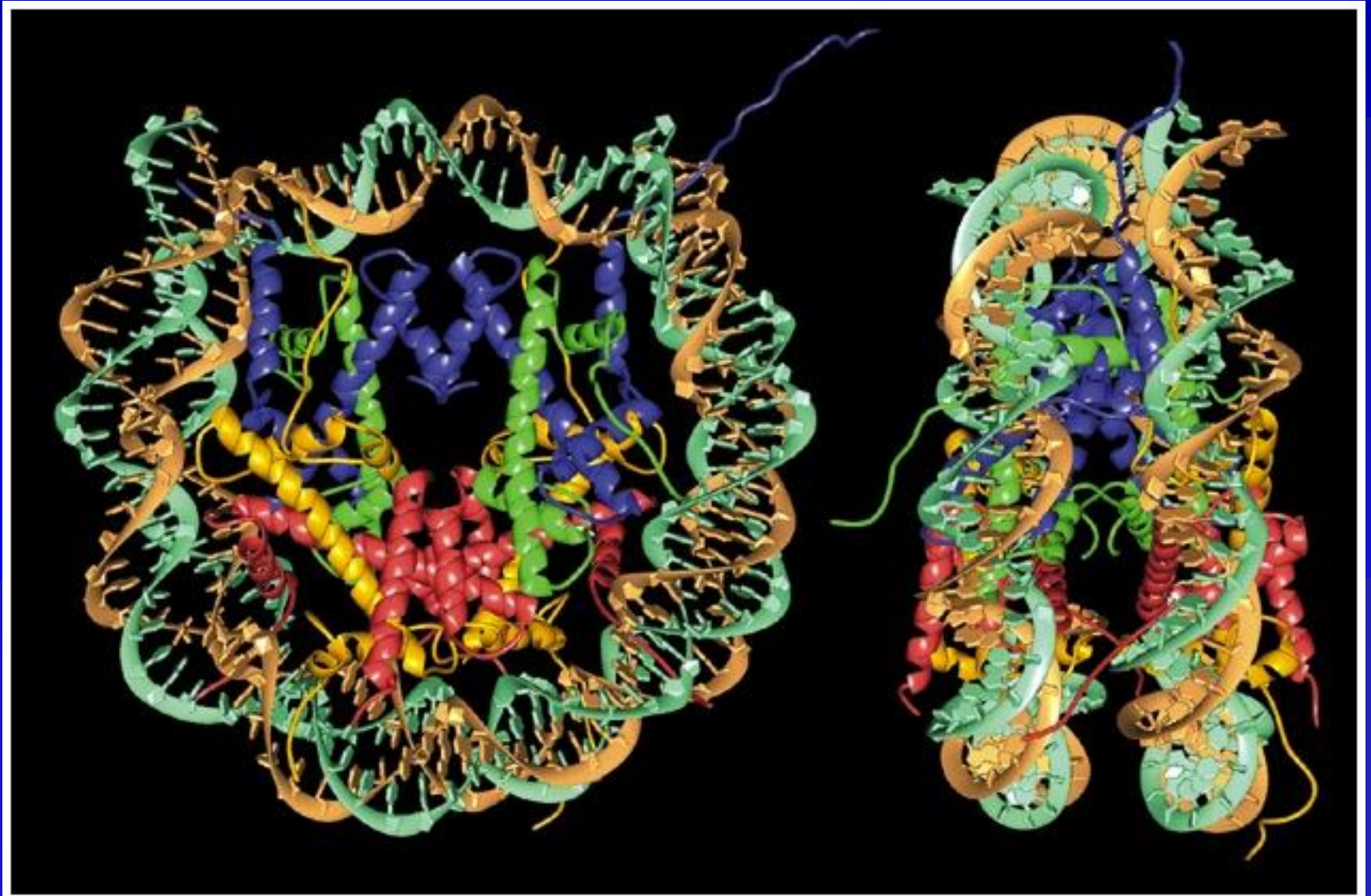


Histones in the nucleosomes are evolutionary conservative, only H1 (in yellow) differs in species and tissues.

Chromatin is a complex of DNA and proteins. Its primary function is packaging long DNA molecules into more compact, denser structures.

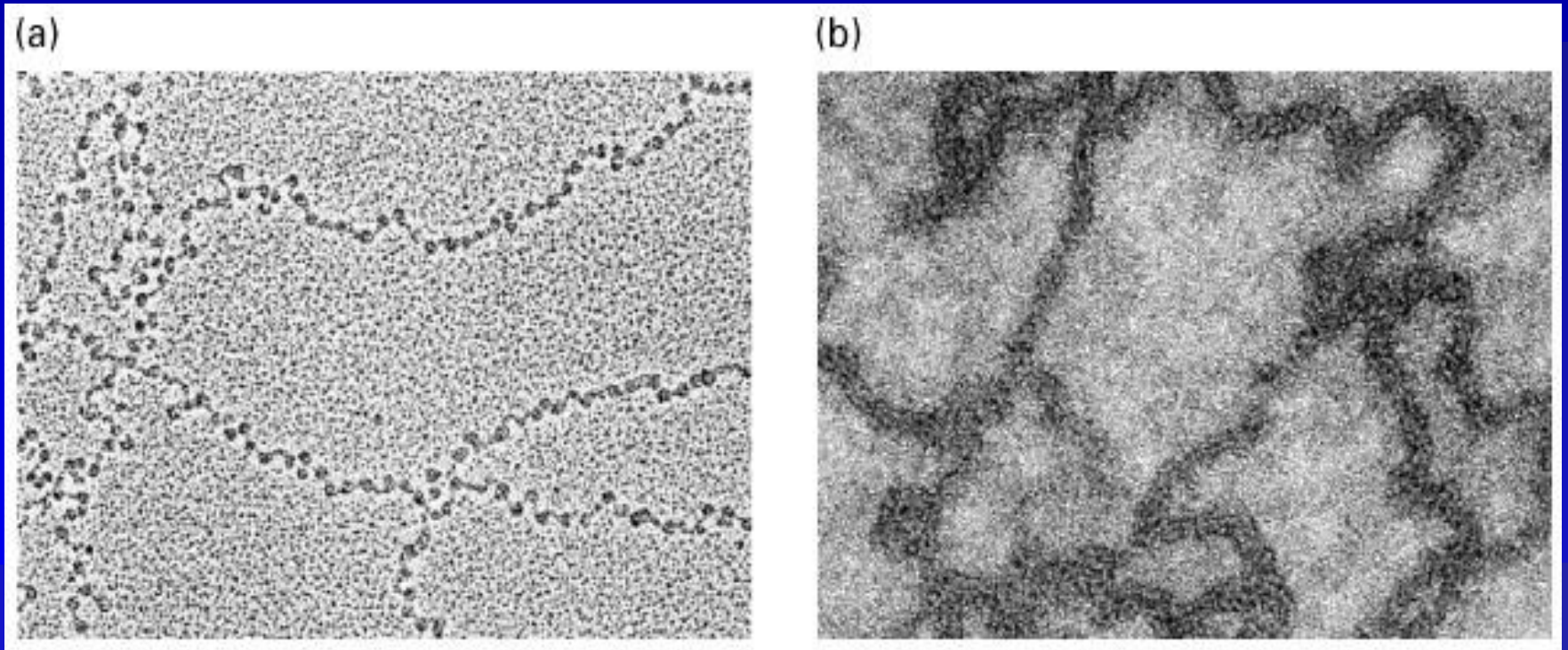


A model of a nucleosome



Beads on a string - removed H1

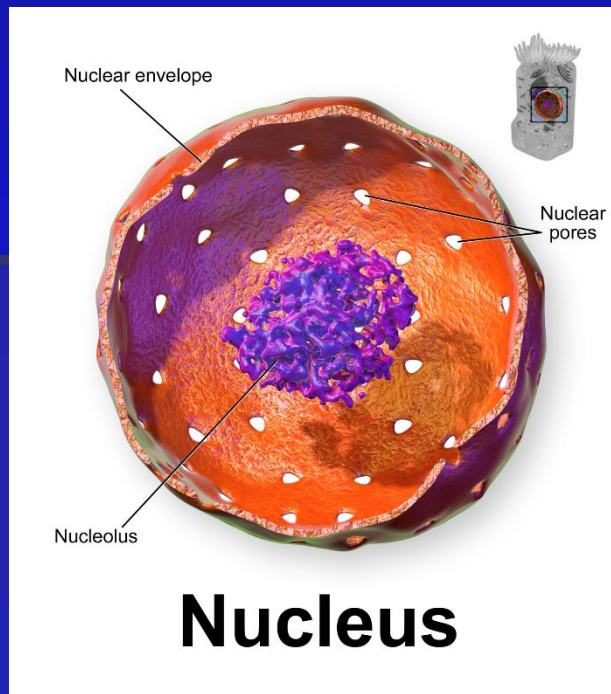
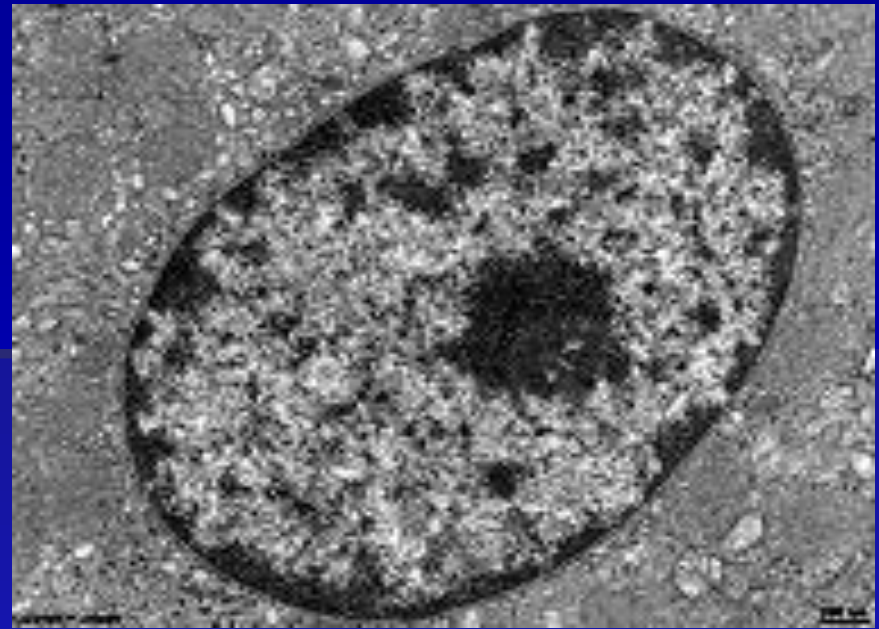
Intact solenoid (30-nm fiber)



The "string" is DNA, and each of the "beads" (nucleosomes) consists of DNA and highly basic proteins called histones.

Euchromatin and heterochromatin

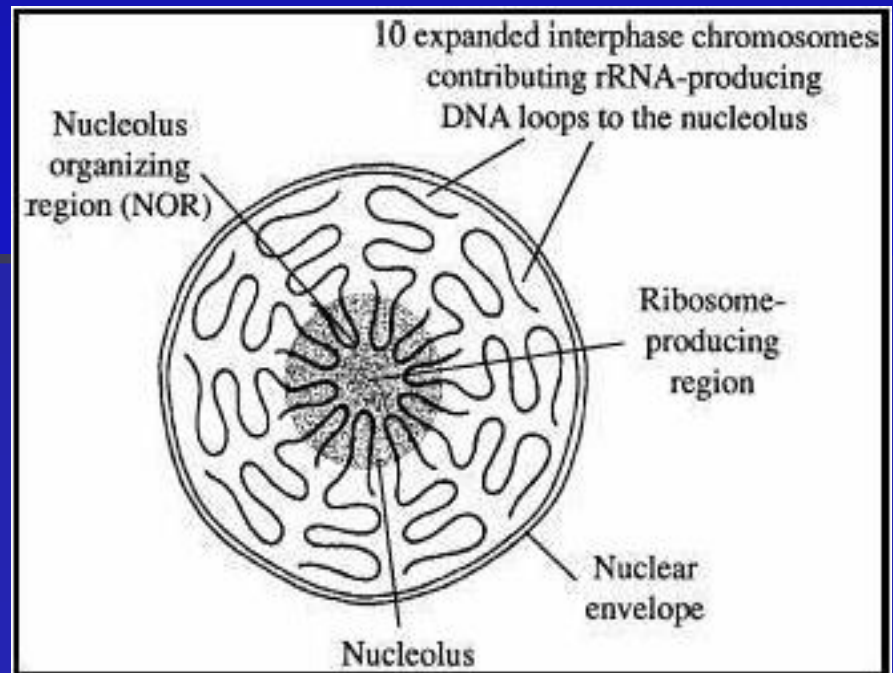
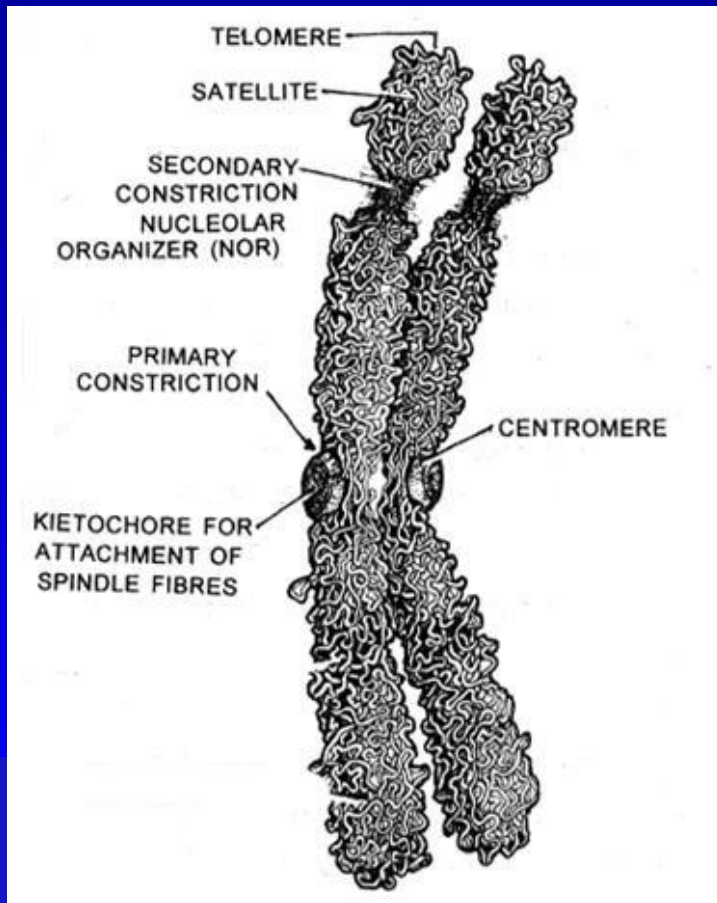
- Euchromatin - the most active portion of the genome
- Heterochromatin - inactive sequences
- Constitutive heterochromatin - poorly expressed, centromere and telomere sequences
- Facultative heterochromatin - not consistent between the cell types within a species; often associated with morphogenesis or differentiation

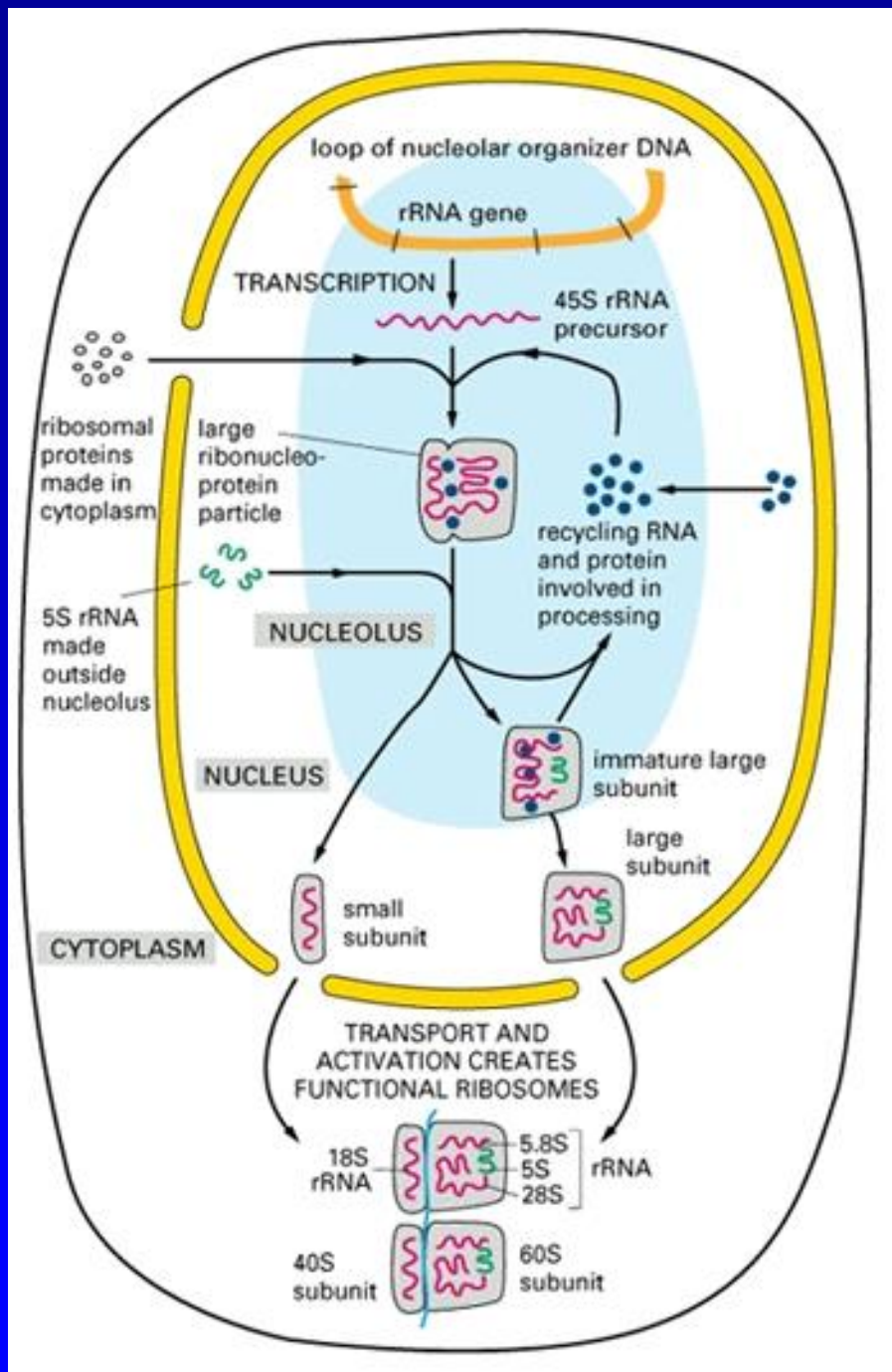


An electron micrograph of a cell nucleus, showing the darkly stained nucleolus and heterochromatin

Nucleolus

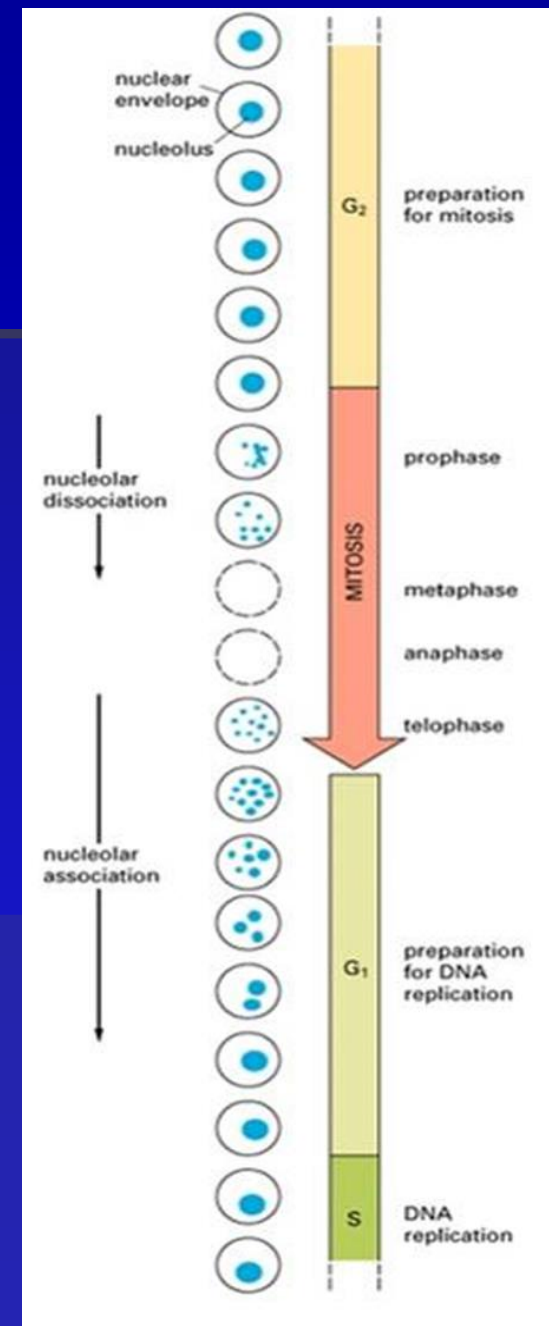
- Nucleolar organizer or nucleolus contain multiple copies of rRNA genes,
- DNA, rRNA, enzymes, ribosomal proteins and subunits
- Disappears during cell division because its DNA must also be packaged in chromosomes





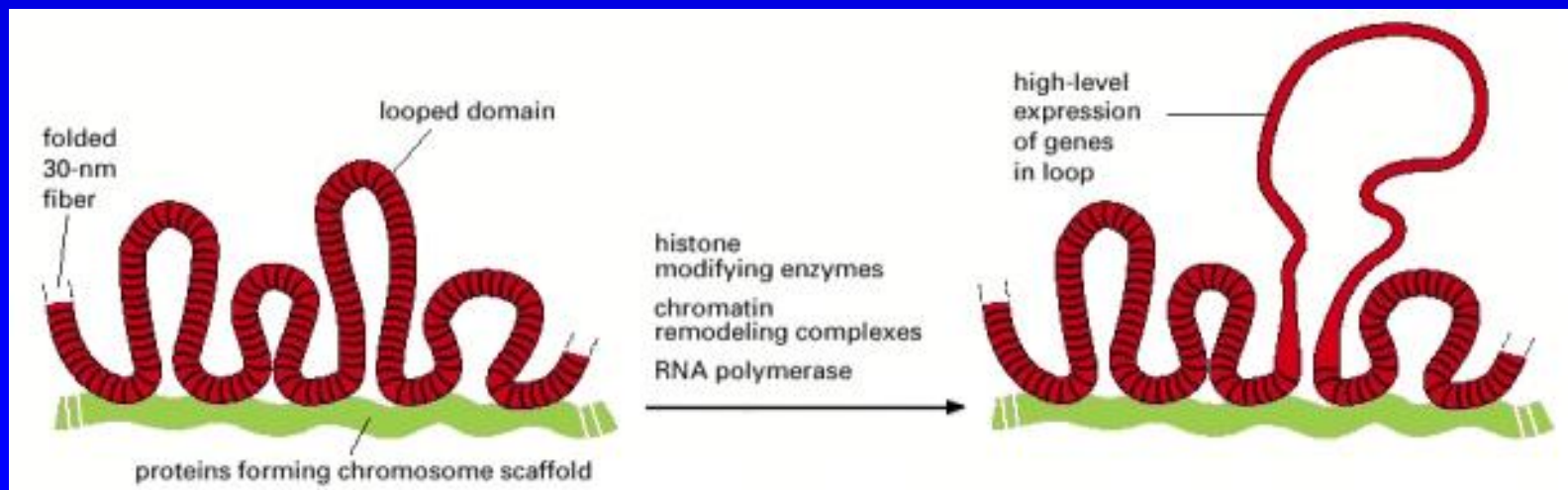
Ribosomal production in the nucleolus

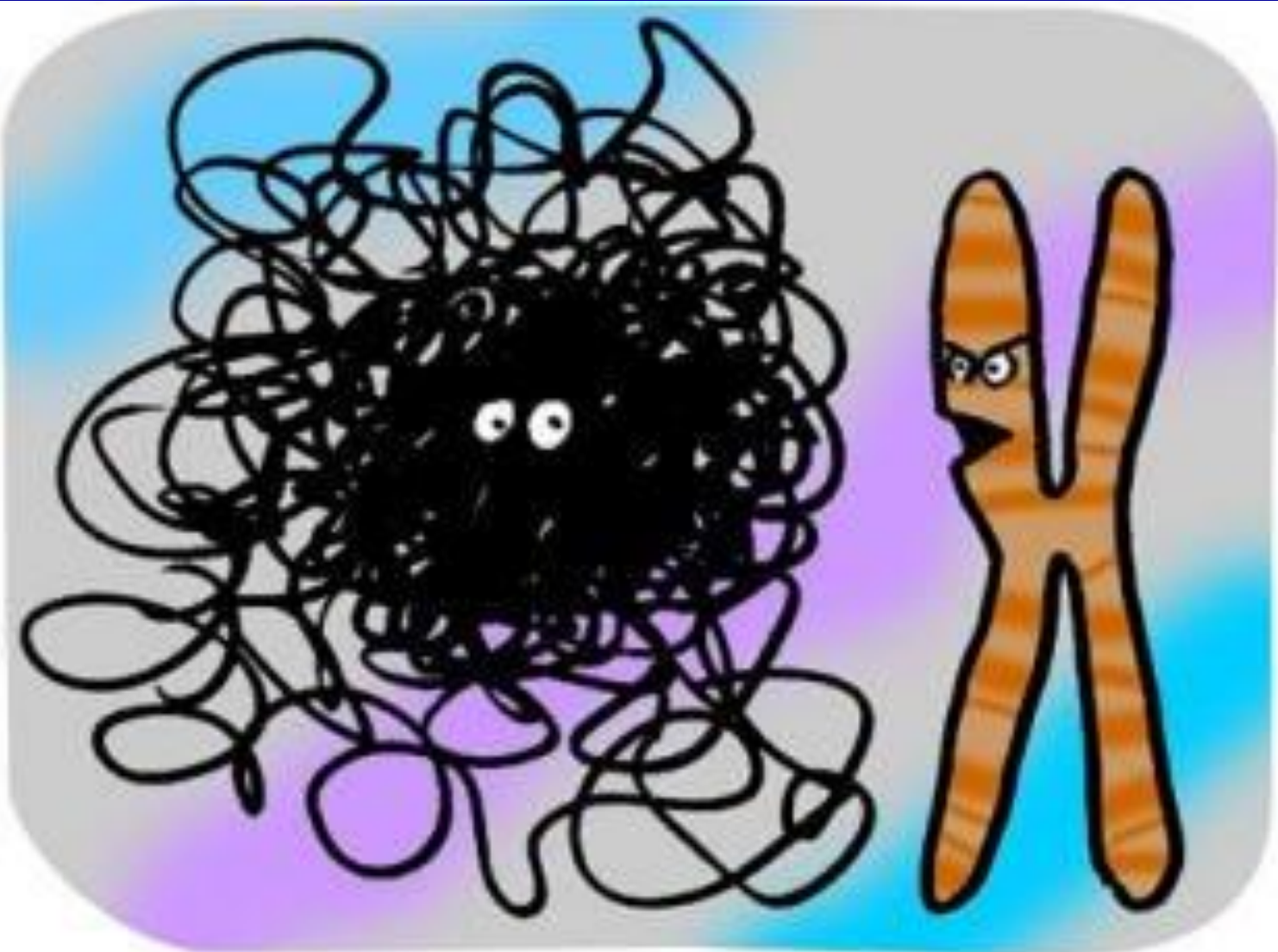
Changes in the appearance of the nucleolus during the cell cycle



A model for the structure of an interphase chromosome

- The interphase chromosome is folded into a series of looped domains
- Individual loops can decondense when the cell requires direct access to the DNA packaged in these loops.
- This decondensation is caused by enzymes that directly modify chromatin structure.





Dude, mitosis starts in five minutes...
I can't believe you're not condensed yet.

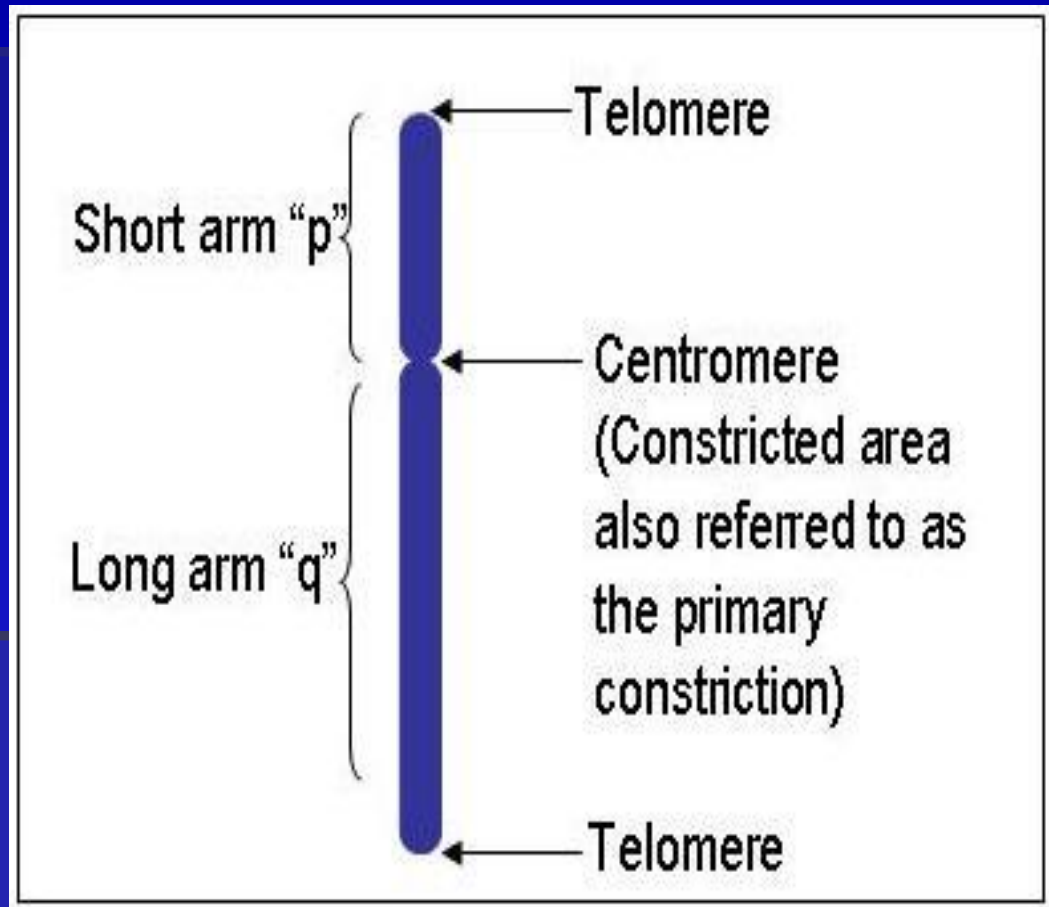
Model of interphase chromatin

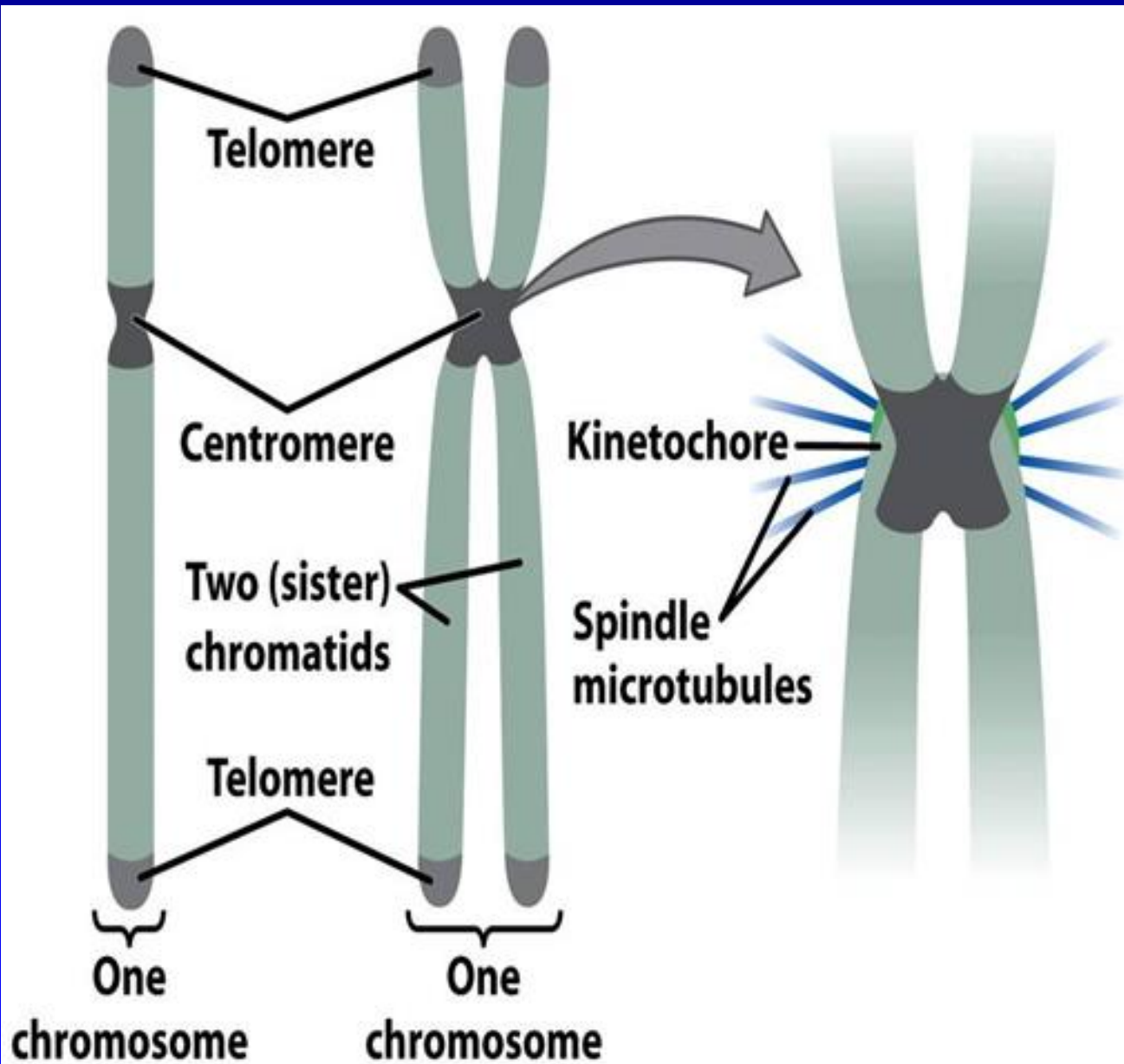


and its packaging into
chromosomes

Parts of the chromosomes

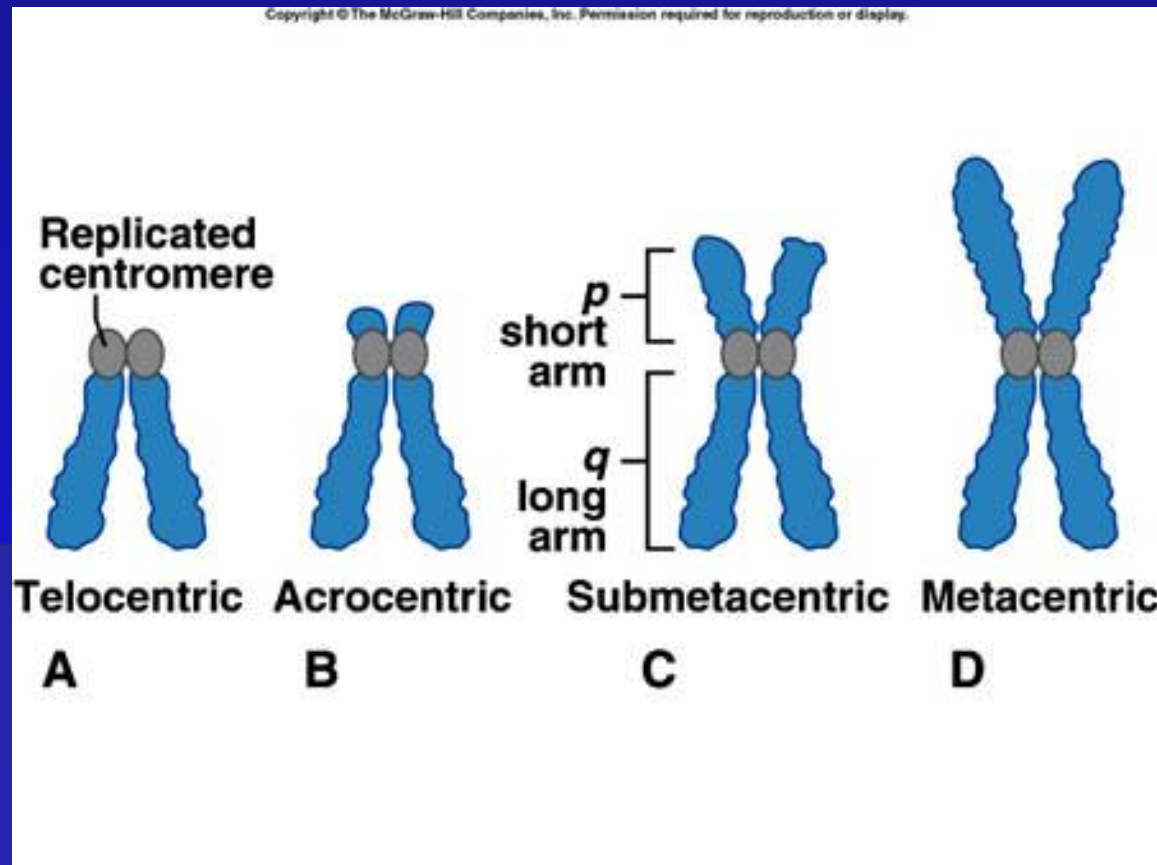
- One chromosome contains one molecule DNA
- Each chromosome has two arms
- Centromere links a pair of sister chromatids; during mitosis, spindle fibers attach to the centromere via the kinetochore proteins
- Telomeres - a region of repetitive nucleotide sequences at each end of a chromosome, which protects the end of the chromosome from deterioration.





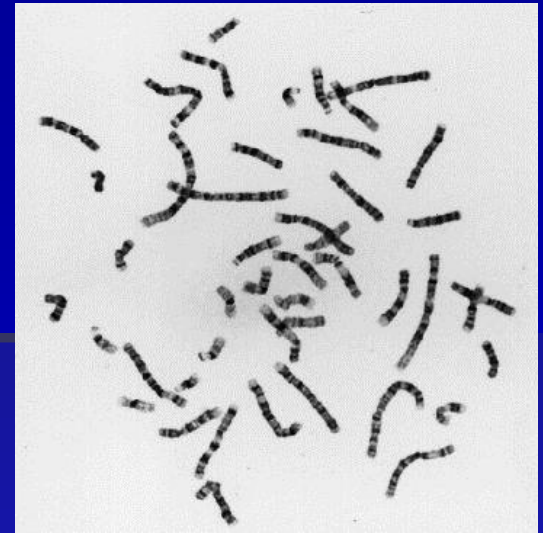
After replication before cell division one chromosome is composed of two DNA molecules which form the two sister chromatids.

Classification of chromosomes based on centromeric position



Karyotype

- The number and appearance of chromosomes in the nucleus of a eukaryotic cell.
- Haploid and diploid set (in gametes and somatic cells, respectively)
- Maternal and paternal chromosomes form homologous pairs
- Autosomes and gonosomes/sex chromosomes
- Karyogram - shows the chromosomes of an organism in homologous pairs of decreasing length



Metaphase chromosomes of a cell

