

The cell nucleus

- * They appear as a round or elongated structure, usually in the center of the cell. The nucleus comprises the nuclear envelope, chromatin, nucleolus, and nuclear matrix.
- * The irregular features plus the capacity to invade neighboring tissues used by pathologists to estimate the degree of malignancy of a tumor.

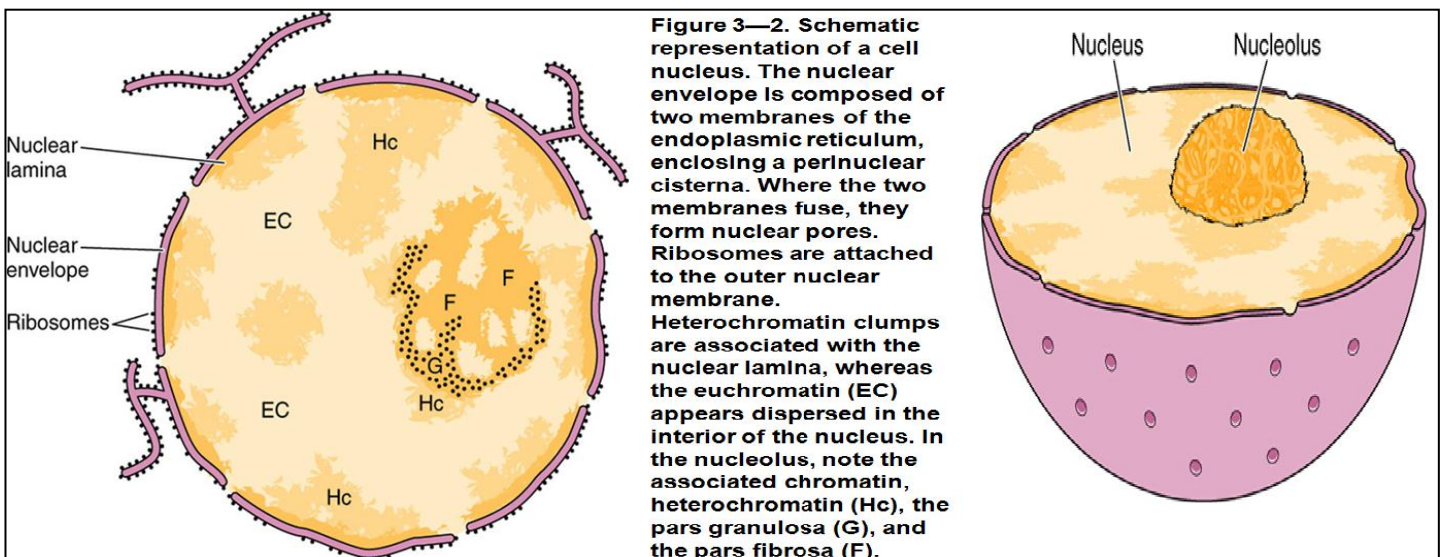
Nuclear envelope

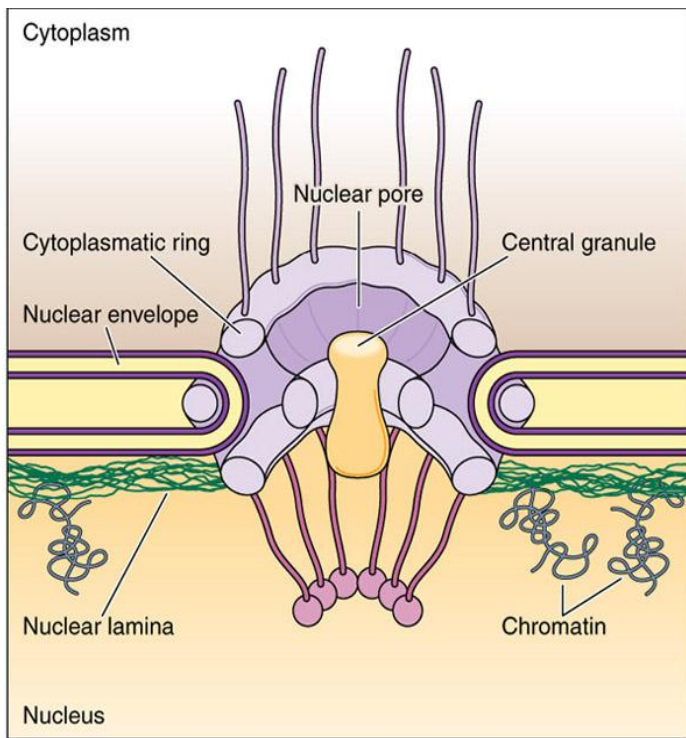
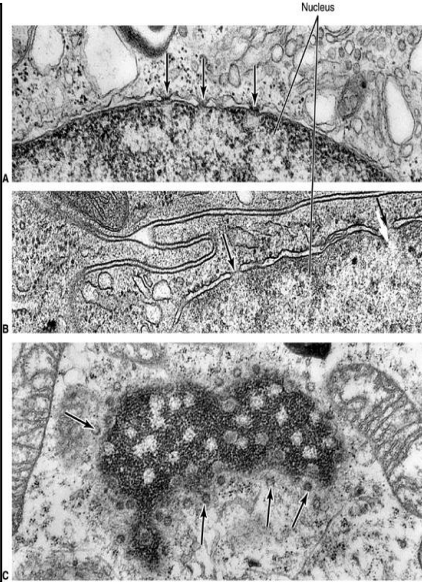
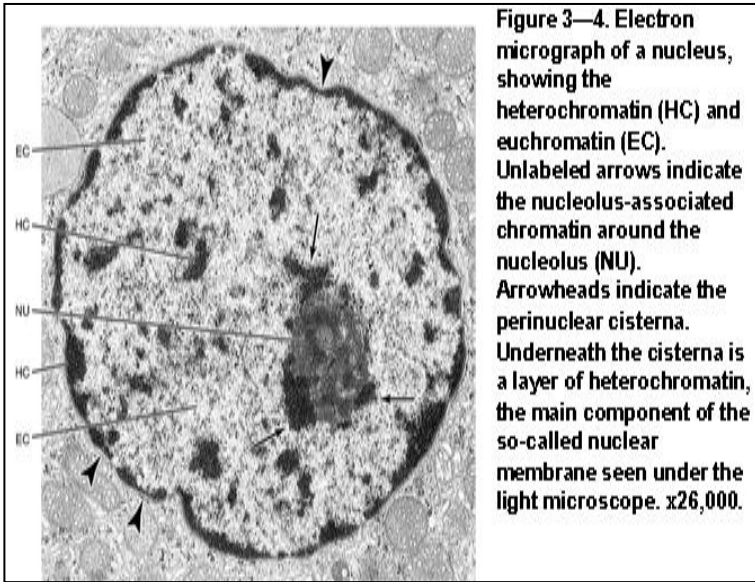
- * Is a thin line of heterochromatin layer surrounding the nucleus and binds to the internal surface of the nuclear envelope. It composes of two parallel unit membranes separated by a narrow (40-70 –nm) space called perinuclear cisterna .

Fibrous lamina, is a protein structure which associated with the internal membrane of nuclear envelope. It is composed of three polypeptides, called lamins that form part of the nuclear matrix .The chromatin has a definite organization within the nucleus.

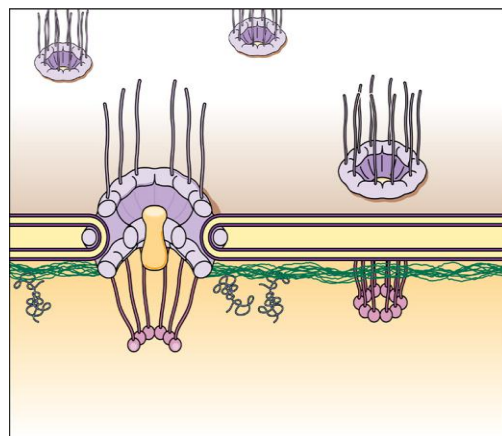
- * Polyribosome attached to the outer membrane .The nuclear envelope functions, synthesizing polypeptide chains and segregating them in the perinuclear cistern between its two membranes

Nuclear pores; are circular gaps found between the inner and outer membranes fuse. They provide pathways between the nucleus and the cytoplasm and are not open but bridged an electron – dense membrane that forms a single-layered diaphragm of protein .All pores are permeable to some macromolecules (e.g , mRNA, cytoplasmic protein) .





- **Figure 3—5. Illustration to show the structure, the localization, and the relationship of the nuclear lamina with chromosomes. The drawing also shows that the nuclear pore complex is made of 2 protein rings in an octagonal organization. From the cytoplasmic ring, long filaments penetrate the cytosol, and from the intranuclear ring arise filaments that constitute a basketlike structure. The presence of the central cylindrical granule in the nuclear pore is not universally accepted.**

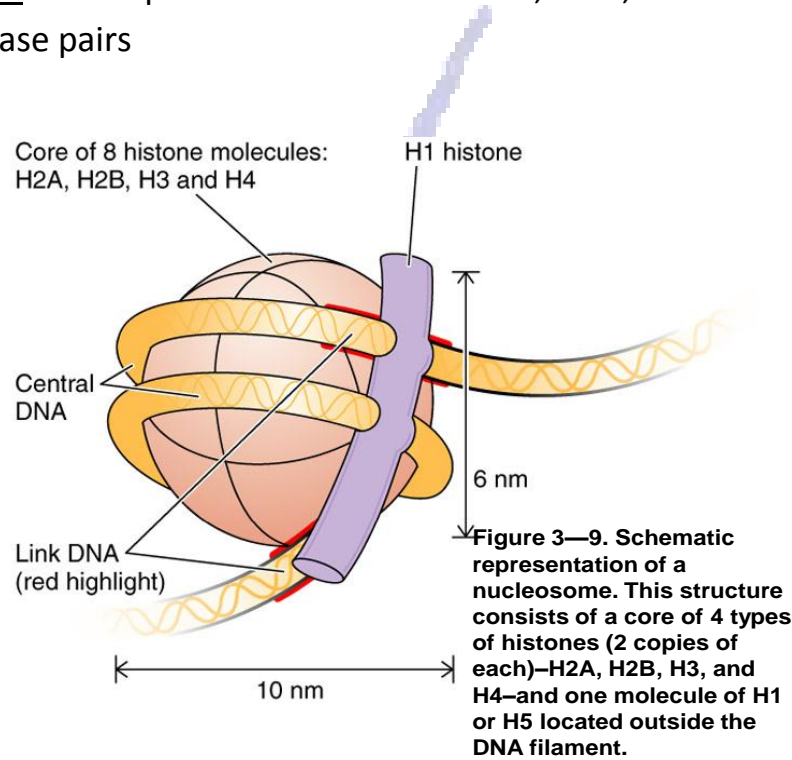


chromatin

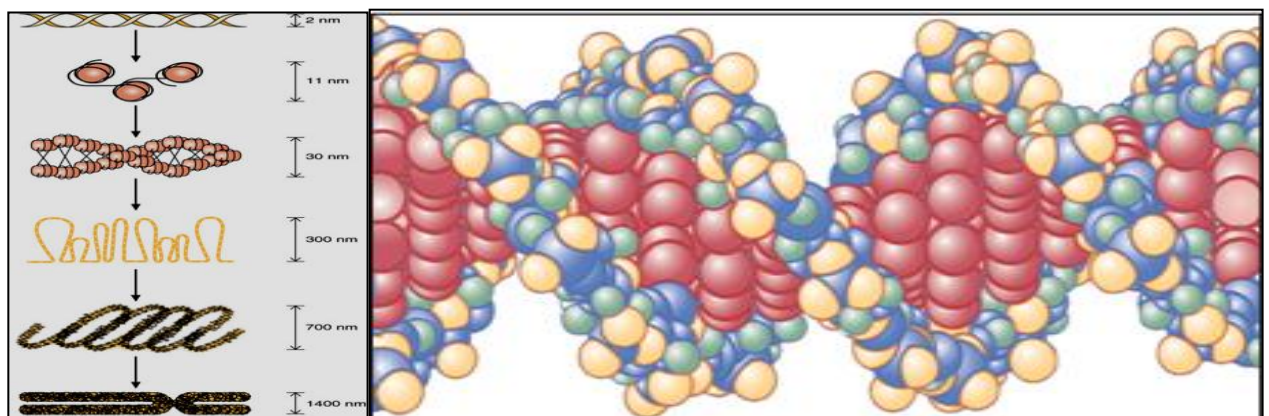
1- Hetrochromatin is visible in the light microscope, appears as coarse granules (as basophilic clumps of nucleoprotein)

2- Euchromatin is visible as an organized structure only in E.M.

- * Chromatin is composed of coiled strands of DNA bound to basic proteins (histones)
- * The basic structural unit of chromatin is the NUCLEOSOME ,which consists of a core of a four types of histones: two copies each of histones H2A, H2B , H3 & H4 around which are wrapped 166 DNA base pairs



* A further 48-base-pair segment forms a link between adjacent nucleosomes, and another type of histone (H1 or H5) is bound to this DNA (BEAD –AN –STRING). The next higher order of organization is The 30-nm fiber (A SOLENOID),in which nucleosomes become coiled around an axis , with six nucleosomes per turn, to form the 30-nm chromatin fiber



- * During mitosis and meiosis there are higher orders of coiling in condensation of chromatin into chromosomes. Within the chromatin, the precursors of the (mRNA, rRNA, and tRNA) are synthesized.
- * In general, cells with light nuclei are more active than those with condensed, dark nuclei. This chromatin clump is the SEX CHROMATIN and is one of the pair of X chromosomes that visible in female cells during interphase. It remains tightly coiled and visible and genetically inactive, while the other X chromosome is uncoiled and not visible
- * In human epithelial cells sex chromosomes appears as a small granule attached to the nuclear envelope. Blood smears are also often used, in which case the sex chromatin appears as a drumstick-like appendage to the nuclei of the neutrophilic leukocytes

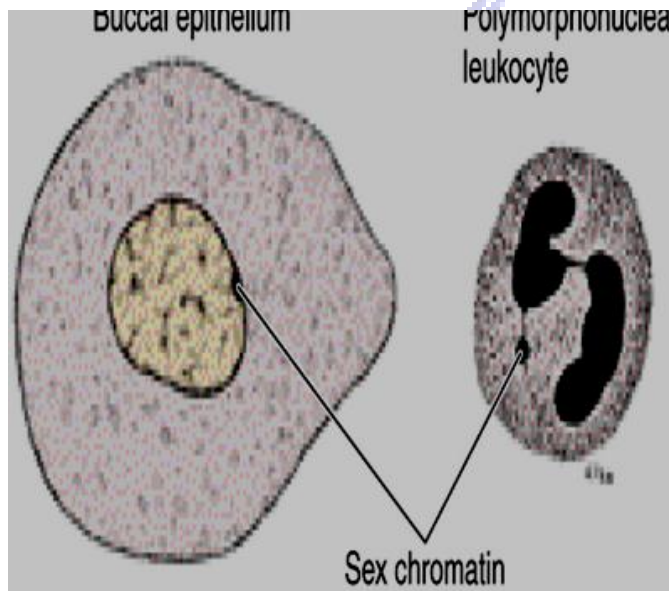


Figure 3—11. Morphologic features of sex chromatin in human female oral (buccal) epithelium and in a polymorph nuclear leukocyte. In the epithelium, sex chromatin appears as a small, dense granule adhering to the nuclear envelope. In the leukocyte, it has a drumstick shape.

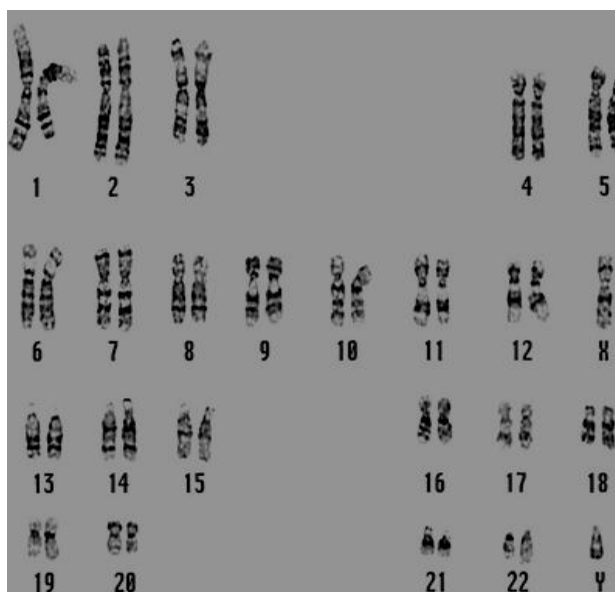


Figure 3—12. Human karyotype preparation made by means of a banding technique. Each chromosome has a particular pattern of banding that facilitates its identification and also the relationship of the banding pattern to genetic anomalies. The chromosomes are grouped in numbered pairs according to their morphologic characteristics.

NUCLEOLUS

* Is a spherical structure that is rich in rRNA and protein .The nucleolus consists of three components :

1- nucleolar organizer DNA –sequences of bases that code for rRNA .

2- Pars fibrosa –ribonucleoprotein fibers, which consist of primary transcripts of rRNA genes.

3- Pars granulosa –consists of 15-20 nm granules (maturing ribosomes). Proteins, synthesized in the cytoplasm, become associated with rRNAs in the nucleolus. Heterochromatin is attached to the nucleolus (nucleolus associated chromatin).In nucleolus they receive proteins and organized into small& large ribosomal subunits, which migrate to cytoplasm through the nuclear pores

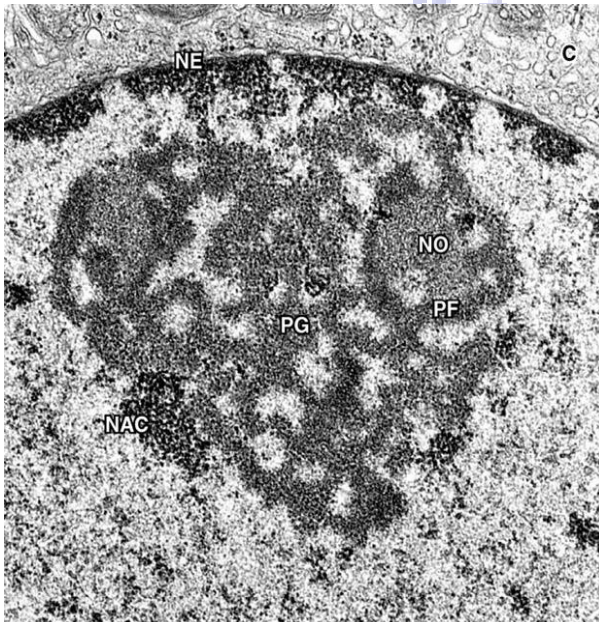


Figure 3—14. Electron micrograph of a nucleolus. The nucleolar organizer DNA (NO), pars fibrosa (PF), pars granulosa (PG), nucleolus-associated chromatin (NAC), nuclear envelope (NE), and cytoplasm (C) are shown.

* The study of sex chromatin has wide applicability to medicine as in hermaphroditism, pseudohermaphroditism,

* Klinefelters syndrome in which testicular abnormalities, azoospermia and other symptoms are associated with the presence of XXY chromosomes in the cell.

NUCLEAR MATRIX

* Is the component that fills the space between the chromatin and the nucleoli in the nucleus .It composes of proteins, metabolites, and ions .There is a fibrillar structure forming the Nucleoskeleton . It probably contributes to the formation of protein base to which DNA loops are bound.