

The nucleus contains a eukaryotic cell's genetic library

- The nucleus contains most of the genes in a eukaryotic cell. (*Where are some others located????*)
- The nucleus regulates protein synthesis
 - Some genes are located in mitochondria and chloroplasts.
 - DNA that programs the synthesis of the proteins made on the organelle's own ribosomes
- The nucleus averages about 5 microns in diameter.
- The nucleus is separated from the cytoplasm by a double membrane, the nuclear envelope.
 - These membranes are separated by 20-40 nm of space. (*A nanometer is a 1 billionth of a meter.....SMALL!*)
- Where the double membranes are fused, a pore allows large macromolecules and particles to pass through (called a nuclear pore).
- The nuclear side of the envelope (that would be the side facing the nucleus) is lined by the **nuclear lamina**, a network of intermediate filaments that maintain the shape of the nucleus.
 - Intermediate filaments are part of a cell's cytoskeleton....and we will talk about this SOON!
- Within the nucleus, the DNA and associated proteins are organized into fibrous material, **chromatin**.
- In a normal cell (non-dividing) they appear as a diffuse mass.
- However when the cell prepares to divide, the chromatin fibers coil up to be seen as separate structures, **chromosomes**.
- Each eukaryotic species has a characteristic number of chromosomes.
 - A typical human cell has 46 chromosomes, but sex cells (eggs and sperm) have only 23 chromosomes.
- In the nucleus is a region of densely stained fibers and granules adjoining chromatin, the **nucleolus – site of ribosome formation**.
 - In the nucleolus, ribosomal RNA (rRNA) is synthesized and assembled with proteins from the cytoplasm to form ribosomal subunits.
 - The subunits pass from the nuclear pores to the cytoplasm where they combine to form ribosomes.
- The nucleus directs protein synthesis by synthesizing messenger RNA (mRNA).

- The mRNA travels to the cytoplasm and combines with ribosomes to translate its genetic message into the primary structure of a specific polypeptide.

Ribosomes build a cell's proteins

- Ribosomes contain rRNA and protein.
- A ribosome is composed of two subunits that combine to carry out protein synthesis.
- Cell types that synthesize large quantities of proteins (e.g., pancreas) have large numbers of ribosomes and prominent nuclei.
- Some ribosomes, *free* ribosomes, are suspended in the cytosol and synthesize proteins that function within the cytosol.
- Other ribosomes, *bound* ribosomes, are attached to the outside of the endoplasmic reticulum.
 - These synthesize proteins that are either included into membranes or for export from the cell.
- Ribosomes can shift between roles depending on the polypeptides they are synthesizing.