Objectives

• Student will need to:
• educate the following organelles and their functions:
• Nucleus; cytoplasm; mitochondria; Golgi apparatus; Ribosomes; Endoplasmic reticulum (rough & smooth); lysosomes
eukaryotic cells like human cells are much more complex, and contain organelles to support different cellular functions from digestion to generation of energy and storage of nutrients. Human cells develop to specific cell types in different organs (differentiations). Specific cell types for specific functions.
May differentiate to different cell-types

Examples of Different Cells

- Epithelial Cell
- Muscle Cell
- Nerve Cell
- Connective Tissue Cell
Eukaryotic cells contain specialized organelles

- Have membrane-bound nucleus and organelles
- Endomembrane system: endoplasmic reticulum, golgi apparatus, lysosomes and peroxisomes
- Energy-related organelles: mitochondria and chloroplast.
The Eukaryotic Cell

- nuclear pores
- DNA
- nucleolus
- cytoskeleton
- smooth endoplasmic reticulum
- free ribosomes
- cytosol
- lysosomes
- rough endoplasmic reticulum
- plasma membrane
- transport vesicle
- mitochondria

Figure 4.4
Plant cells have a cell wall, chloroplasts, and a central vacuole, while animal cells do not.
Inside the Cell - cytoplasm
Cytoplasm (not an organelle - but important)

✓ All organelles reside (live and float around in) the cytoplasm.
Cytoplasm

Clear, gelatinous fluid found in the cells that are the site of numerous chemical reactions.
The Cell Nucleus

- Nucleolus
- Nuclear Envelope
- Nuclear Pores
- Chromosomes
- Chromatin

Figure 1
Nucleus

- Control center of the cell
- Separated from cytoplasm by nuclear membrane/nuclear envelope
- Contains genetic material – DNA arranged in thread-like structure called chromatin
- Also contain RNA and proteins
- Nucleolus – distinct part in the nucleus where ribosome synthesis takes place
The nucleus is the largest cellular organelle in animals. In mammalian cells, the average diameter of the nucleus is approximately 6 micrometers (μm), which occupies about 10% of the total cell volume. The viscous liquid within it is called nucleoplasm, and is similar in composition to the cytosol found outside the nucleus. It appears as a dense, roughly spherical organelle.
• Eukaryotic cells contain a nucleus.
• It has got two membranes- nuclear envelope.
• Outer membrane is continuous with the membrane of endoplasmic reticulum.
• Nuclear envelope has numerous pores. That permit controlled movement of particles and molecules between the nuclear matrix and cytoplasm.
• Most proteins, ribosomal subunits, and some RNAs are transported through the pore complexes in a process mediated by a family of transport factors known as karyopherins. Those karyopherins that mediate movement into the nucleus are also called importins, while those that mediate movement out of the nucleus are called exportins.

• The space between the membranes is called the Perinuclear space and is continuous with the RER lumen.

• the nuclear lamina, a meshwork within the nucleus that adds mechanical support, much like the cytoskeleton supports the cell as a whole.
The entry and exit of large molecules from the nucleus is tightly controlled by the nuclear pore complexes. Although small molecules can enter the nucleus without regulation, macromolecules such as RNA and proteins require association karyopherins called importins to enter the nucleus and exportins to exit.
**Architectures of nucleus**

- **Chromatin:** DNA with histones and non-histone proteins
- **Nucleolar protein (vehicle):**
  - **Pore complex:**
    - Outer membrane
    - Inner membrane
  - Luminal subunit
- **Nuclear pores**
- **Ribosome:** RNA translated to protein
- **Inner membrane**
- **Outer Nuclear membrane**

**Nucleolus:** ribosomal RNA genes are being transcribed to make ribosomal RNAs.
• Anucleated and polynucleated cells
• Although most cells have a single nucleus, some eukaryotic cell types have no nucleus, and others have many nuclei. This can be a normal process, as in the maturation of mammalian red blood cells, or a result of faulty cell division.
summery

• This lecturer is about cytoplasmic organelles of eukaryotic cell.

• Nucleus, the largest structure, pores in its envelope to transport materials.

• The nuclei of eukaryotic cells and their types.

• To be continued in the next lecture, for the remaining organelles.