

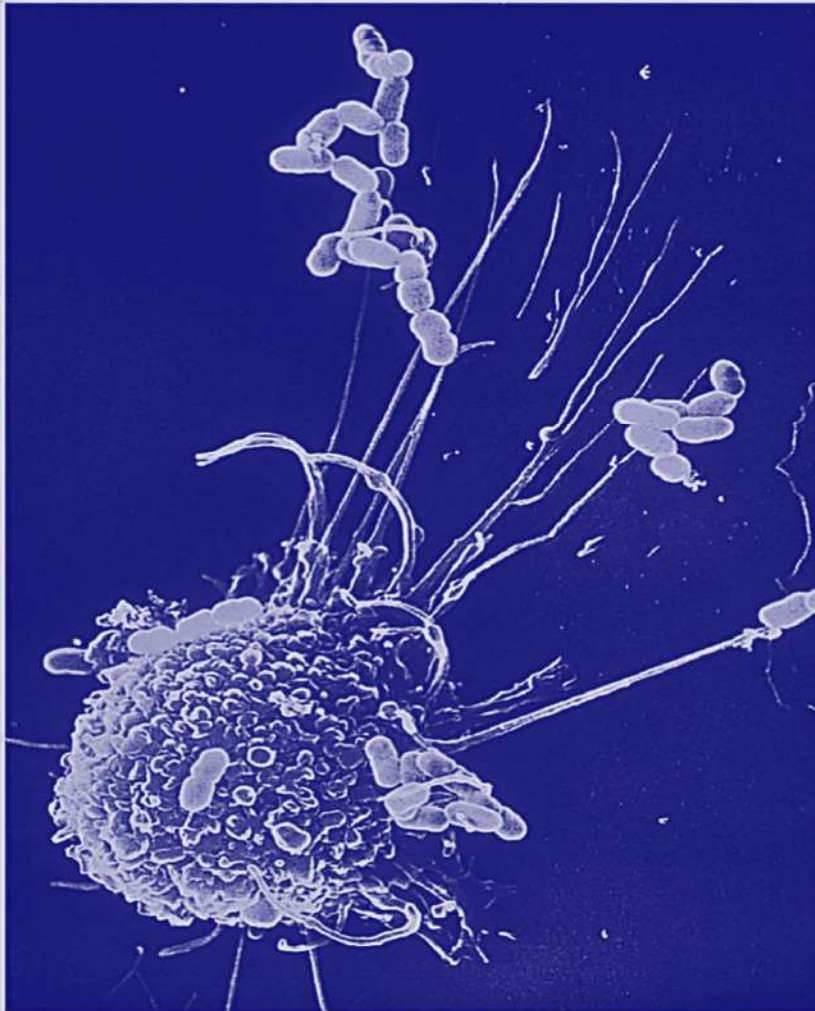
**CELL BIOLOGY &
PHYSIOLOGY**

جامعة
الملك سعود
King Saud University



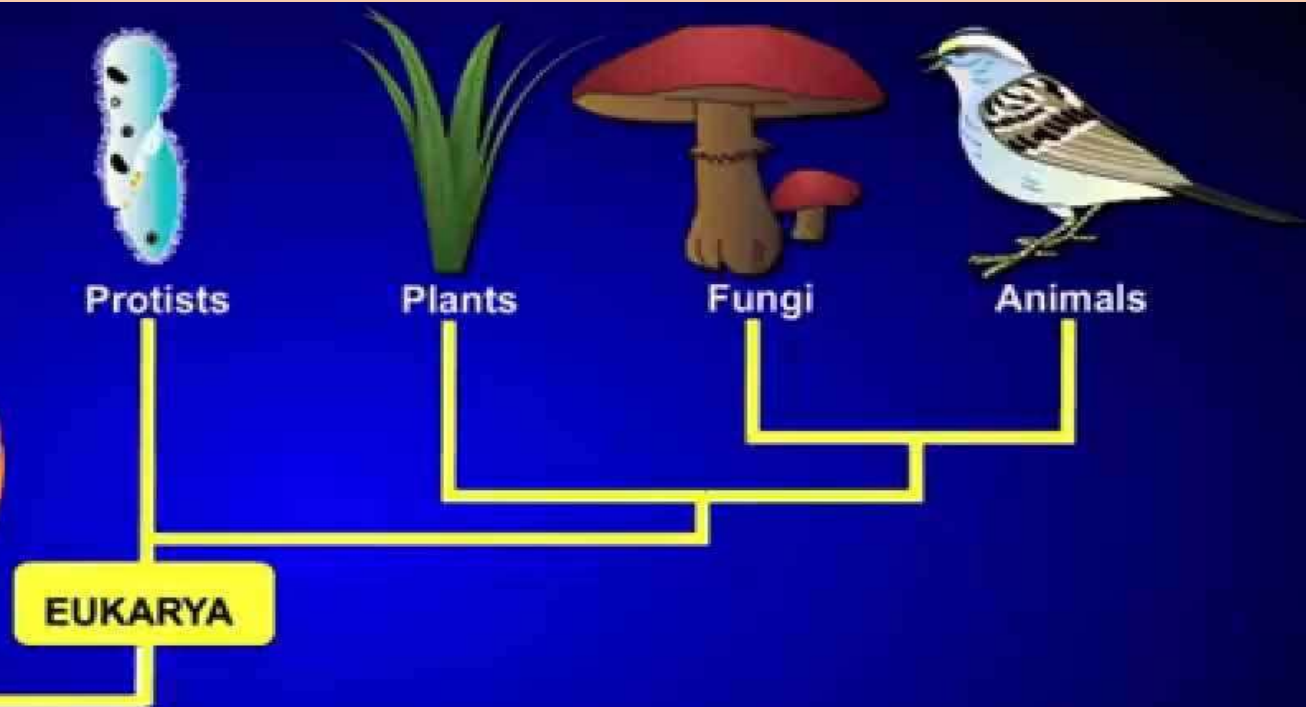
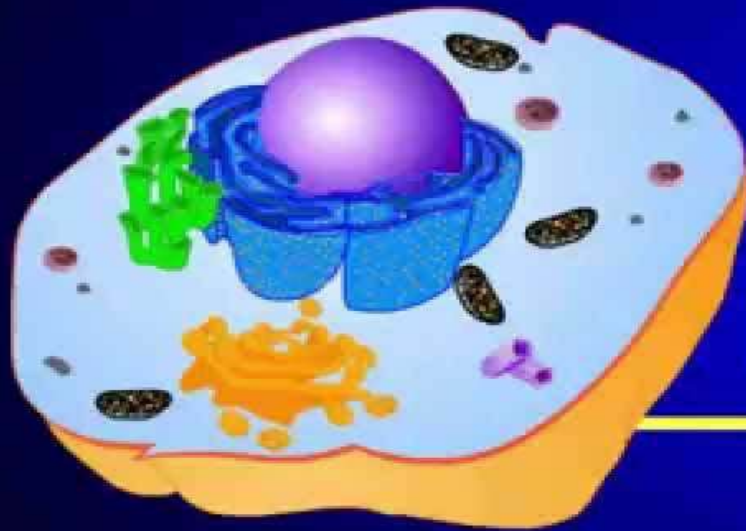
college of sciences
Zoology Department

**Cell Biology and Physiology
ZOO (242)**





EUKARYOTIC ORGANISM





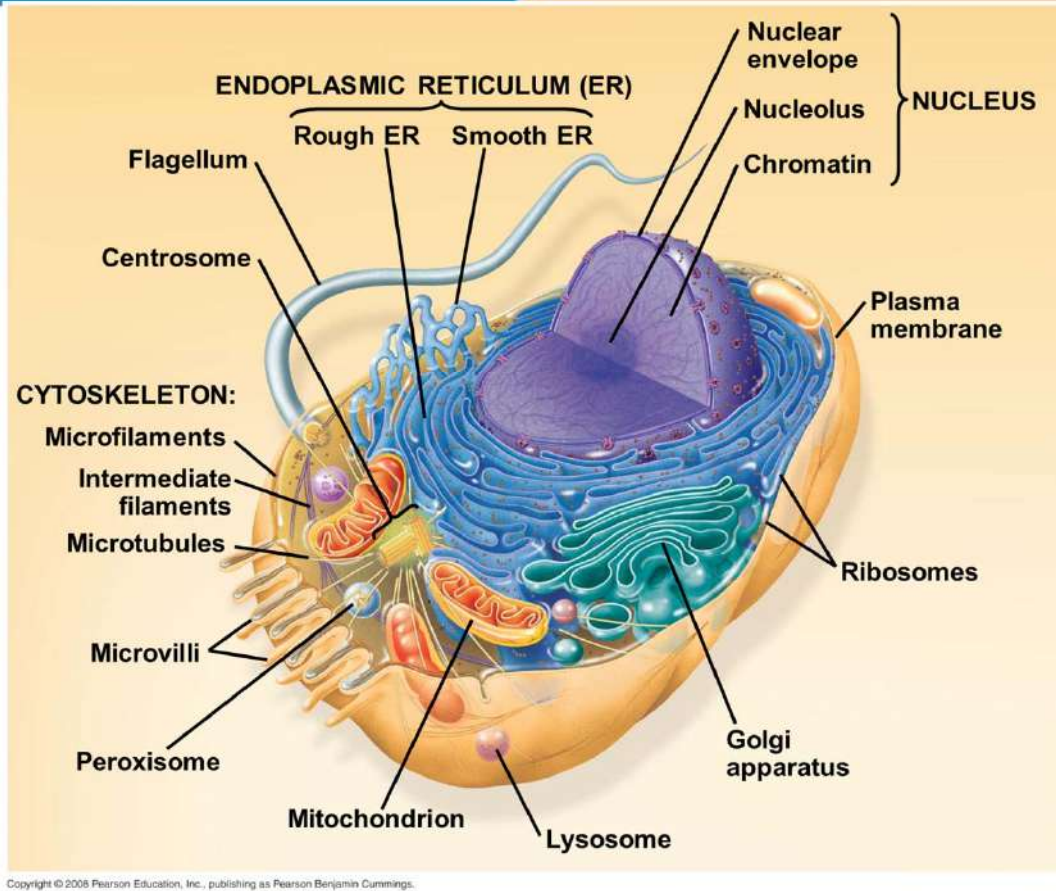
Introduction

- Eukaryotic cells are those cells, which are complex and larger than the prokaryotic cells.
- The term eukaryote is derived from the Greek word (eukaryon) eu, (true), and karyon, (kernel, nucleus of cell) meaning true or good nuclei. Eukaryotic cells can be easily distinguished through a membrane-bound nucleus.
- This cell includes all life kingdoms except monera. The life, which is present and visible by our naked eye, is all made up of these cells.
- Eukaryotic cells have a multiple membrane-bound organelles to carry out specific cell tasks.

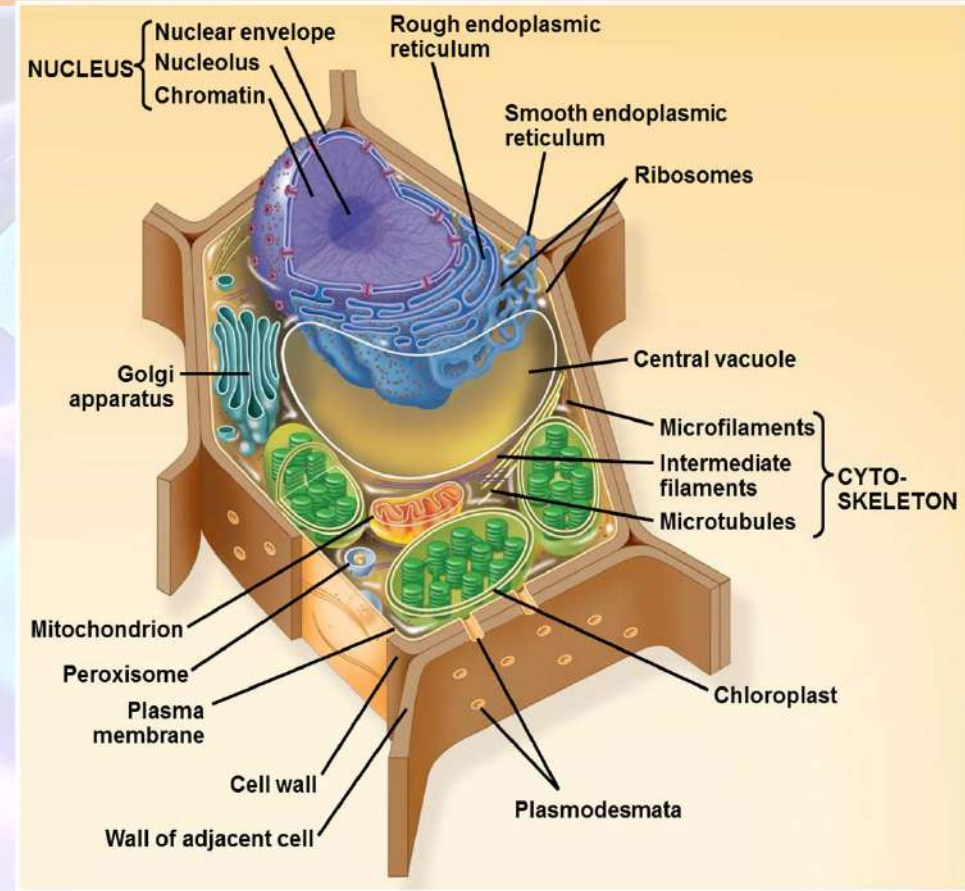
الخلايا حقيقية النواة هي تلك الخلايا التي تكون معقدة وأكبر من الخلايا بدائية النواة.

مصطلح eukaryote مشتق من الكلمة اليونانية (eu)، **حقيقية** karyon، **نواة**، التي تشير هنا إلى النواة وتعني النواة الحقيقية أو الجيدة. يمكن تمييز الخلايا حقيقية النواة بسهولة من خلال نواة مرتبطة بالغشاء

تشمل هذه الخلية جميع ممالك الحياة باستثناء مونيرا. تتكون الحياة، الموجودة والمرئية بالعين المجردة، من هذه الخلايا. تحتوي الخلايا حقيقية النواة على عضيات متعددة مرتبطة بالغشاء للقيام بمهام خلوية محددة.



Animal cell



Plant cell



Eukaryotic cell structure

- A eukaryotic cell is organized into three principal zones:
- The nucleus.
- The cytoplasm.
- The plasma membrane.
- Located in the cytoplasm are numerous organelles, which perform specific functions for the cell.

يتم تنظيم الخلية حقيقية النواة في ثلاث مناطق رئيسية:

النواة.

السيتوبلازم.

غشاء البلازما.

يوجد في السيتوبلازم العديد من العضيات التي تؤدي وظائف

محددة للخلية.



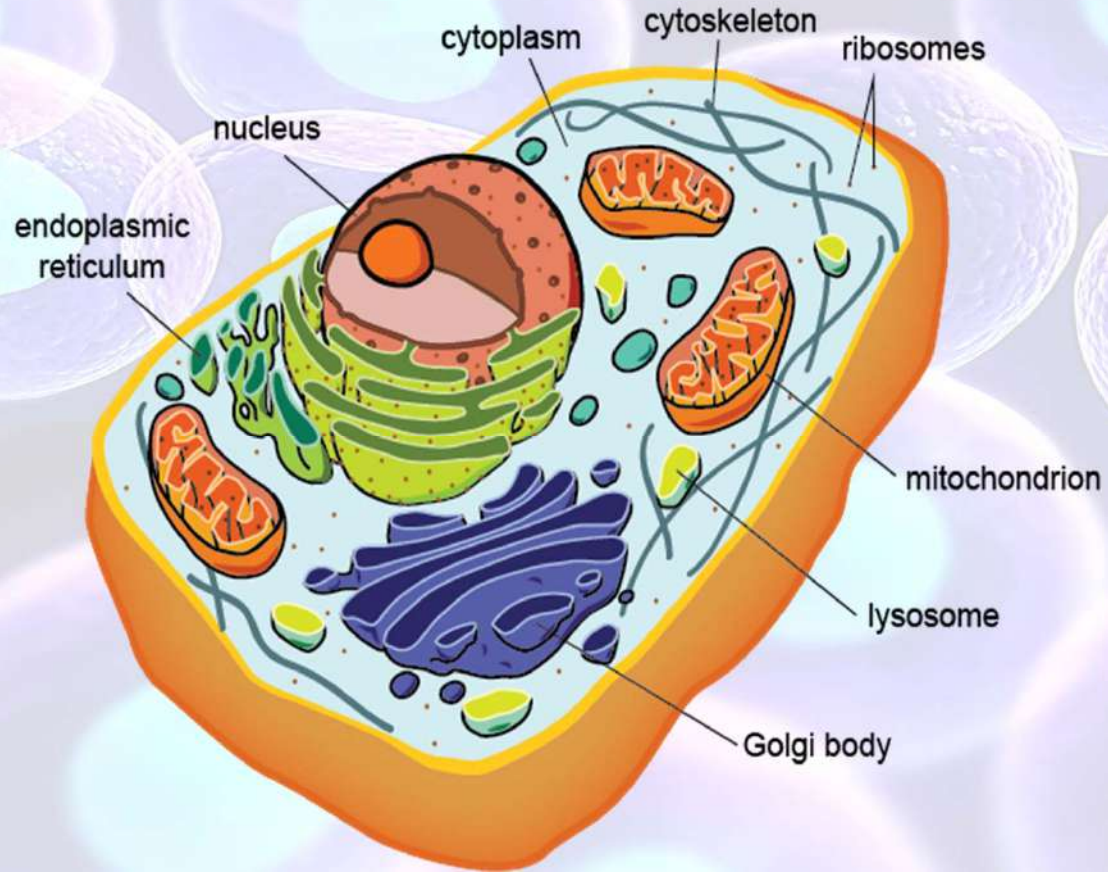
Eukaryotic Cell organelles

- They have a variety of internal membrane-bound structures, called organelles
- These organelles play a vital role in cell maintenance and other functions.
- These organelles generally consist of cell wall, plasma membrane, nucleus, mitochondria, chloroplasts (plastids), endoplasmic reticulum, ribosome, Golgi apparatus, lysosomes, vacuoles, and cytoplasm.

لديهم مجموعة متنوعة من الهياكل الداخلية المرتبطة بالغشاء ،
تسمى العضيات

تلعب هذه العضيات دورًا حيويًا في صيانة الخلايا والوظائف
الأخرى.

تتكون هذه العضيات بشكل عام من جدار الخلية ، وغشاء
البلازما ، والنواة ، والميتوكوندريا ، والبلاستيدات الخضراء
(البلاستيدات) ، والشبكة الإندوبلازمية ، والريبوسوم ، وجهاز
جولجي ، والجسيمات الحالة ، والفجوات ، والسيتوبلازم.





The nucleus:

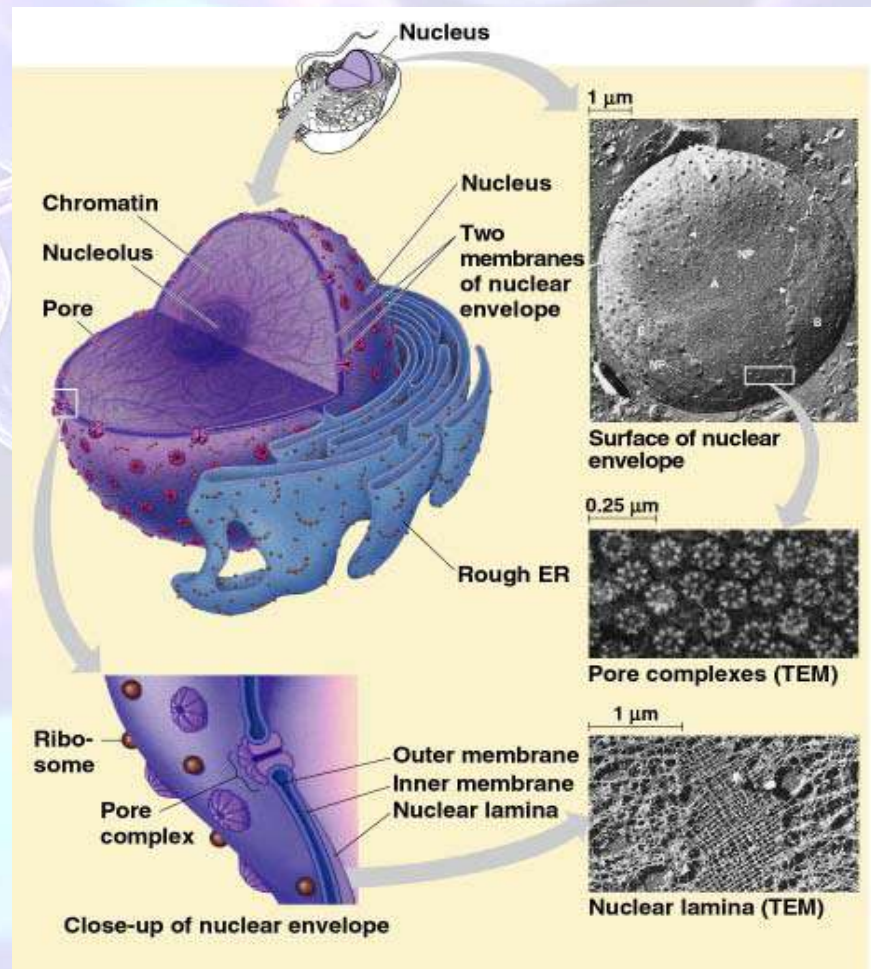
Contains the cell's genetic library

The nucleus contains most of the genes in an eukaryotic cell as it is the storage for genetic material.

The nucleus is separated from the cytoplasm by a double membrane called nuclear envelope.

It directs activities of the cell.

The nuclear membrane is maintaining the shape of the nucleus.





The nucleus contains the “**chromatin fibers**” which are made up of **DNA** and **Histone proteins**.

The semifluid matrix found inside the nucleus is called **nucleoplasm**.

The nucleus also contains one or more nucleoli.

Nucleolus is a dark region involved in production of ribosomes.

When the cell prepares to divide, the chromatin fibers coil up and condensed to be seen as “**chromosomes**”.

Each eukaryotic species has a characteristic number of **chromosomes**.

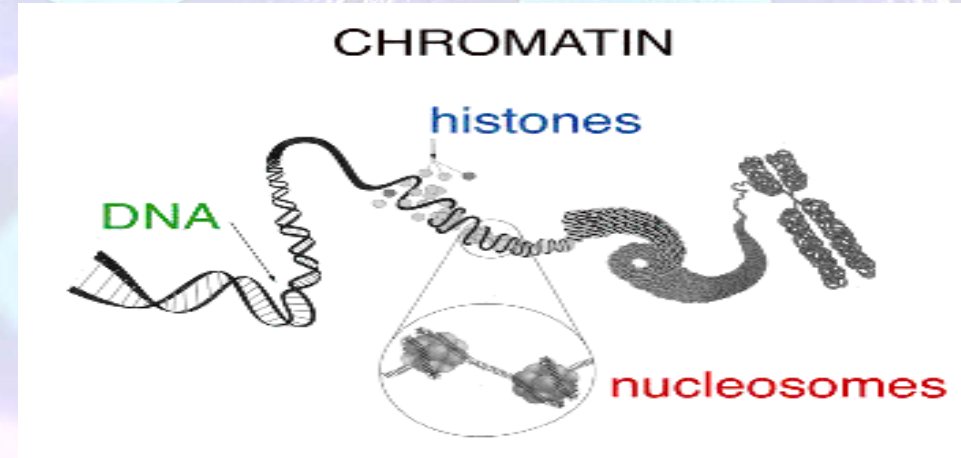
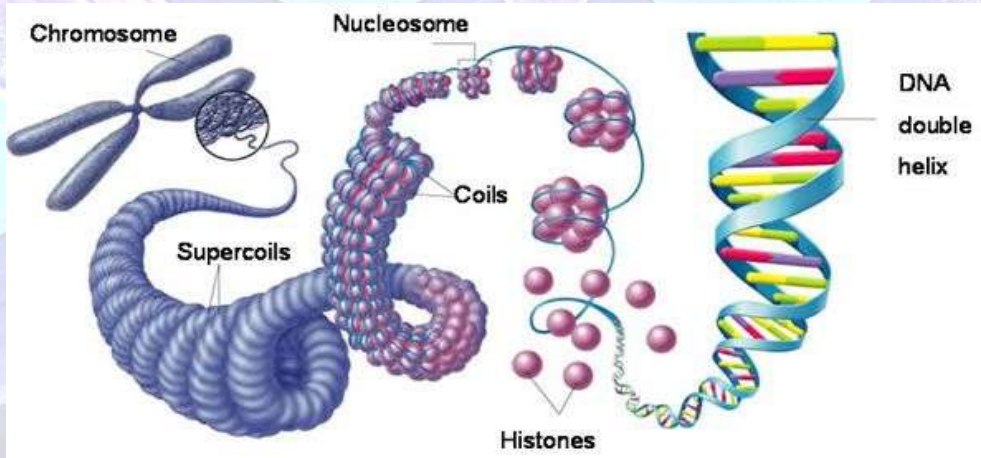
- A typical human cell has **46 chromosomes**, but sex cells or gametes (eggs and sperms) have only **23 chromosomes**.

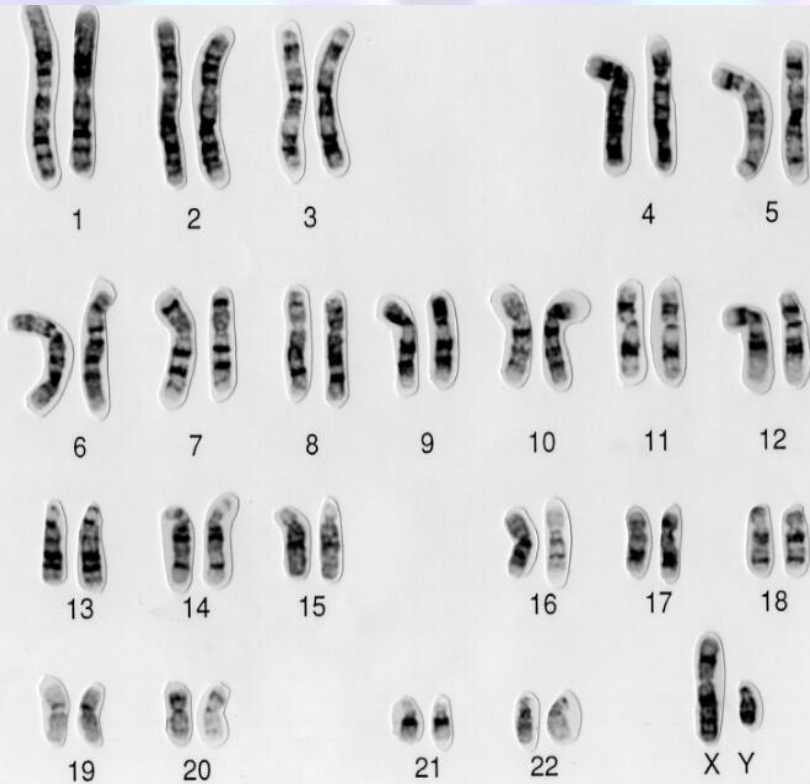
The nucleus directs protein synthesis by synthesizing messenger RNA (mRNA).

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

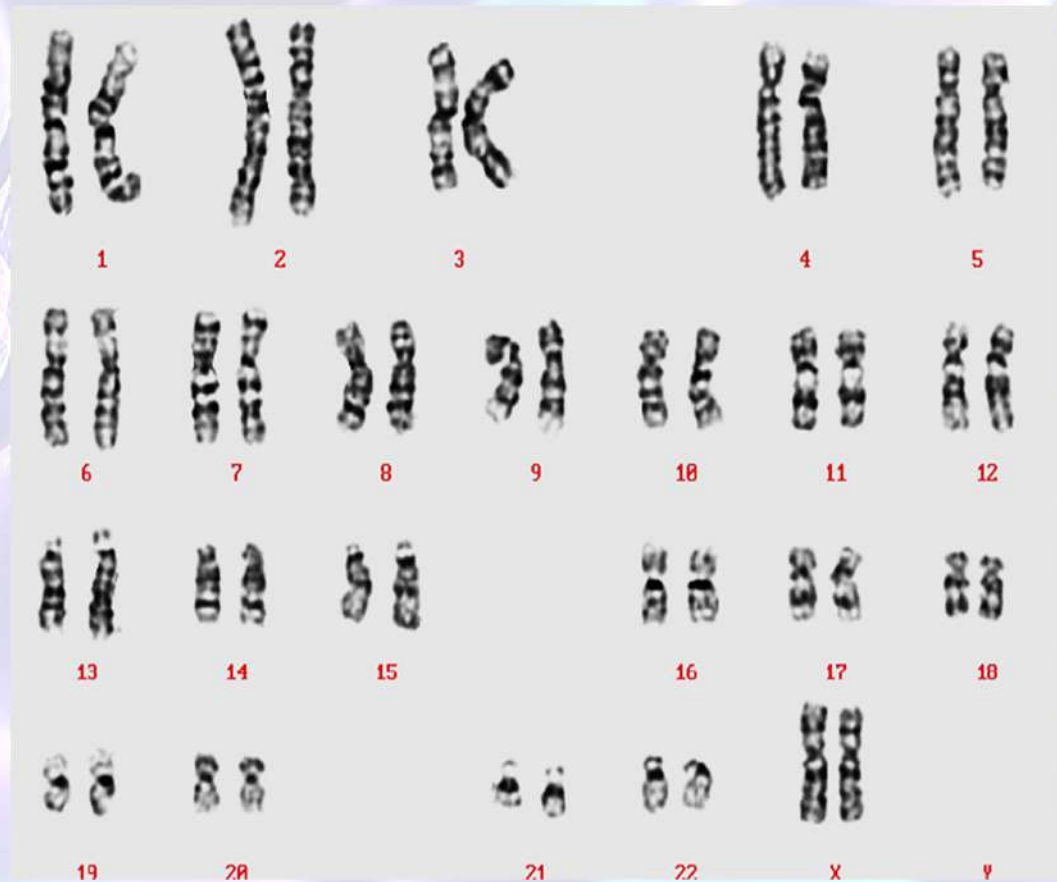


Eukaryotic DNA





Normal human male 44 + XY



Normal human Female 44 + XX



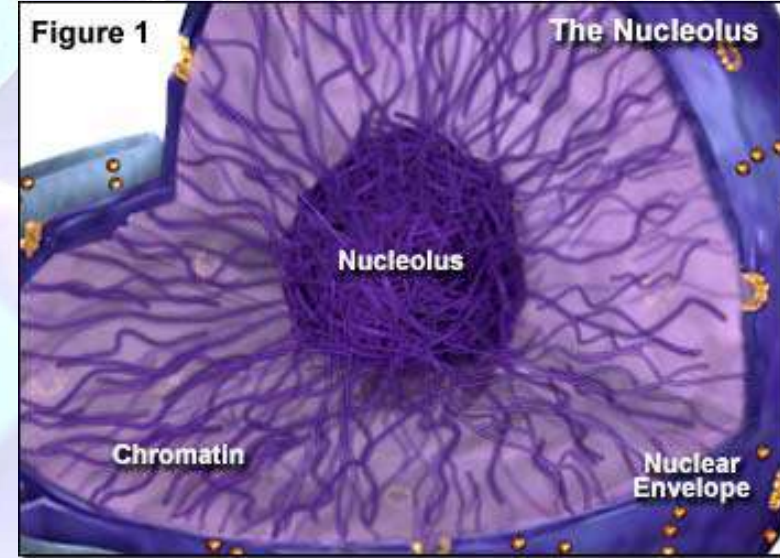
Nucleolus

Through the microscope, the nucleolus appears like **a large dark spot within the nucleus.**

Eukaryotic cells often contain a single nucleolus, but several are also possible. The exact number of nucleoli is fixed among members of the same species.

Each diploid cell in the human body has only one nucleolus, though immediately after cell division ten tiny nucleoli appear before they fused into a single, large nucleolus.

Nucleolus organizer regions (NORs) are **chromosomal regions crucial for the formation of the nucleolus (located at acrocentric Chromosome (Ch 13,14,15, 21, and 22)).** The DNA found at chromosomal NORs encodes the genes for ribosomal RNA.

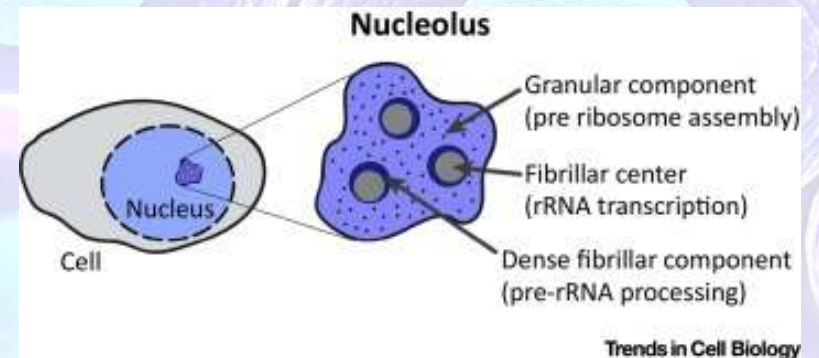




The nucleolus is comprised of **granular** and **fibrillar**.

The granular material has ribosomal subunits that are formed but still not yet matured and are supposed to be exported to the cytoplasm.

There is a possible connection between the nucleolus and cell senescence (aging).



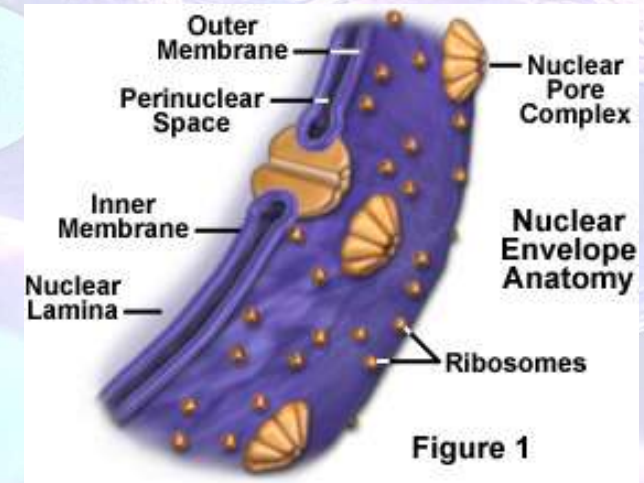


The Nuclear Envelope

The nuclear envelope is a double-layered membrane that encloses the contents of the nucleus during most of the cell's lifecycle.

The outer membrane and the inner nuclear membrane are fused together at numerous tiny holes called **nuclear pores** that perforate the nuclear envelope.

The space between the outer and inner membranes is termed the **perinuclear space**.

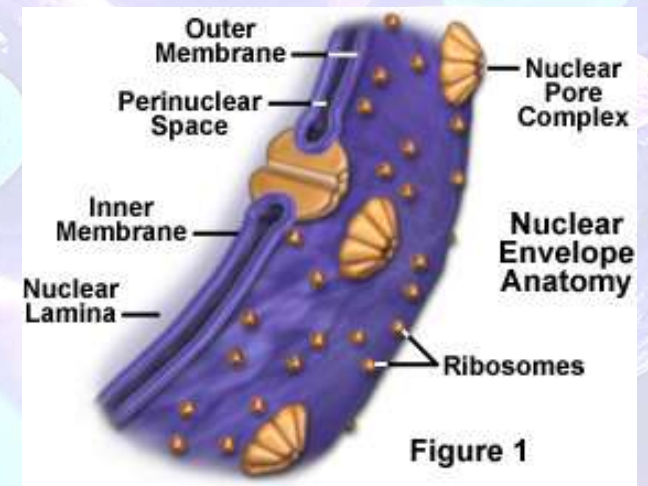
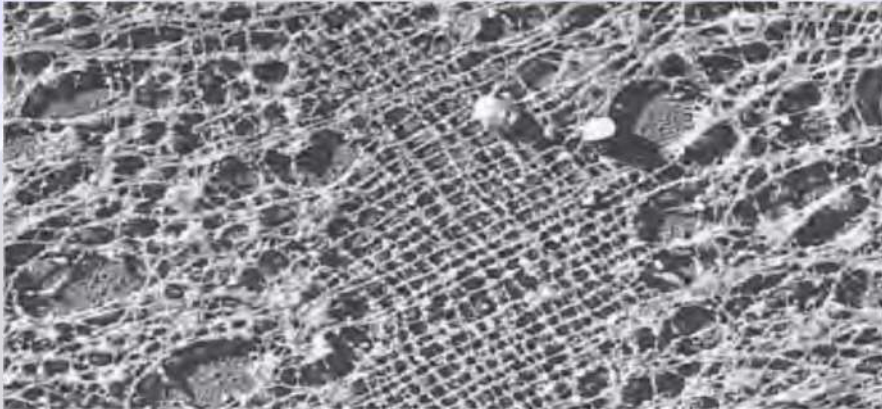


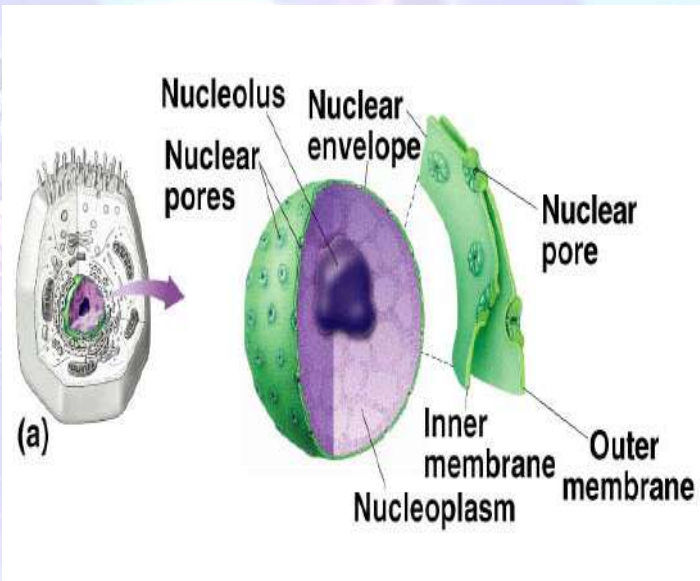


Nuclear lamina (found in the inner membrane) which binds to chromatin, integral membrane proteins, and other nuclear components.

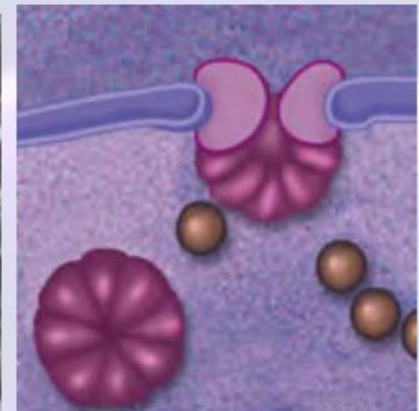
Maintains the shape of the nucleus by mechanically supporting the nuclear envelope.

Has a role in directing materials inside the nucleus toward the nuclear pores for export.





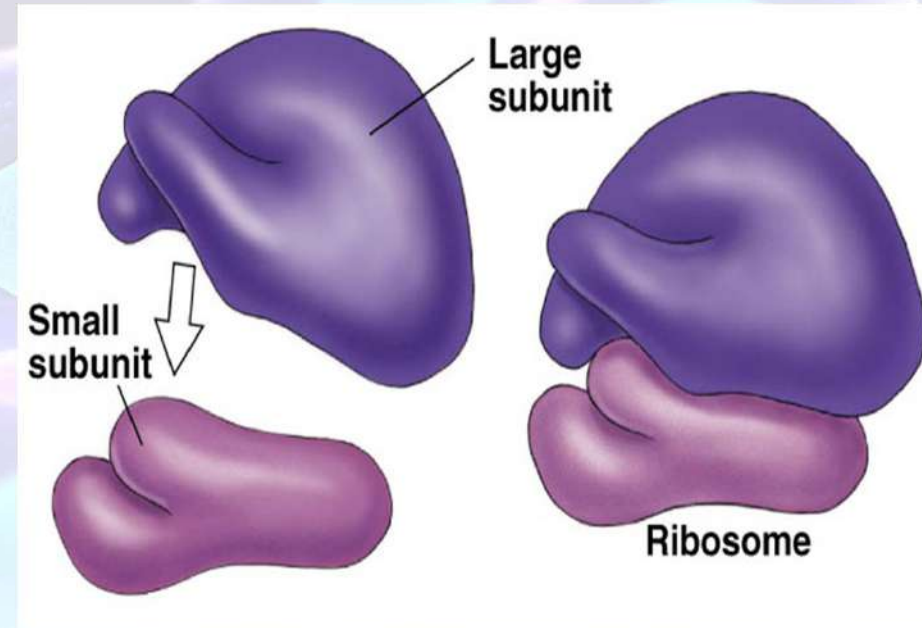
The nuclear envelope is perforated with tiny holes known as **nuclear pores**. These pores regulate the passage of molecules between the nucleus and cytoplasm, permitting some to pass through the membrane, but not others.





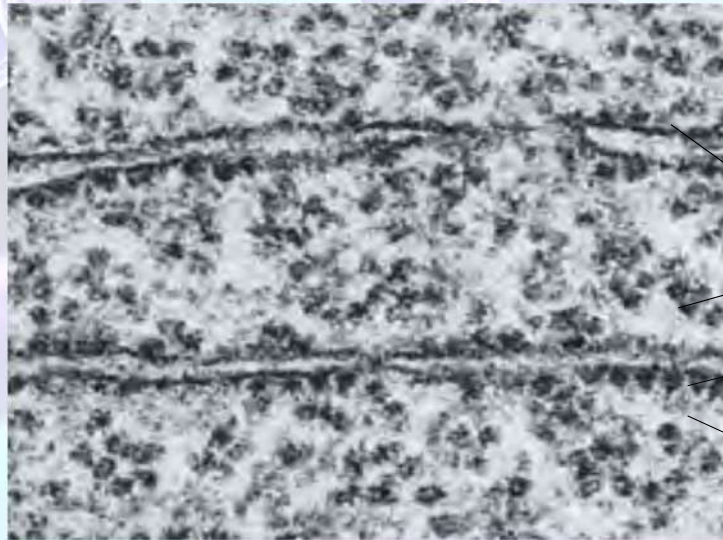
Ribosomes

- **Ribosomes** are complexes made of ribosomal RNA and protein, are the cellular components that carry out protein synthesis.
- Composed of two subunits (large and small) that join and attach to messenger RNA to carry out protein synthesis.
- Cells that have high rates of protein synthesis have particularly large numbers of ribosomes. For example, a human pancreas cell has a few million ribosomes.





- Ribosomes build proteins in two cytoplasmic locations.
- **Free ribosomes** ; At any given time, free ribosomes are suspended in the cytosol,
- **Bound ribosomes**; while bound ribosomes are attached to the outside of the endoplasmic reticulum or nuclear envelope



free ribosomes

endoplasmic reticulum

bound ribosomes



Summary

- Eukaryotic cells can be easily distinguished through a membrane-bound nucleus.
- The life, which is present and visible by our naked eye, is all made up of these cells.
- They have a variety of internal membrane-bound structures, called organelles
- Eukaryotic cells are generally much larger than prokaryotic cells.
- Eukaryotes can reproduce both by asexual reproduction through mitosis and sexual reproduction through meiosis.



Summary

- Eukaryotic cells have internal membranes that compartmentalize cellular functions.
- Plant and animal cells have most of the same organelles: a nucleus, endoplasmic reticulum, Golgi apparatus, and mitochondria.
- Some organelles are found only in plant or in animal cells.
- The nucleus is surrounded by double membrane (nuclear envelope) having holes by nuclear pores; continuous with endoplasmic reticulum (ER).
- Houses chromosomes, which are made of chromatin (DNA and proteins); contains nucleoli, where ribosomal subunits are made; pores regulate entry and exit of materials.
- The eukaryotic cell's genetic instructions are housed in the nucleus and carried out by the ribosome.



References

- “A Tour of the Cell.” Biology by Jane B Reece; Neil A Campbell; et al Boston : Benjamin Cummings / Pearson, ©2011. English : 9th ed. chapter 06
- Video by
- <https://www.youtube.com/watch?v=gG7uCskUOrA>