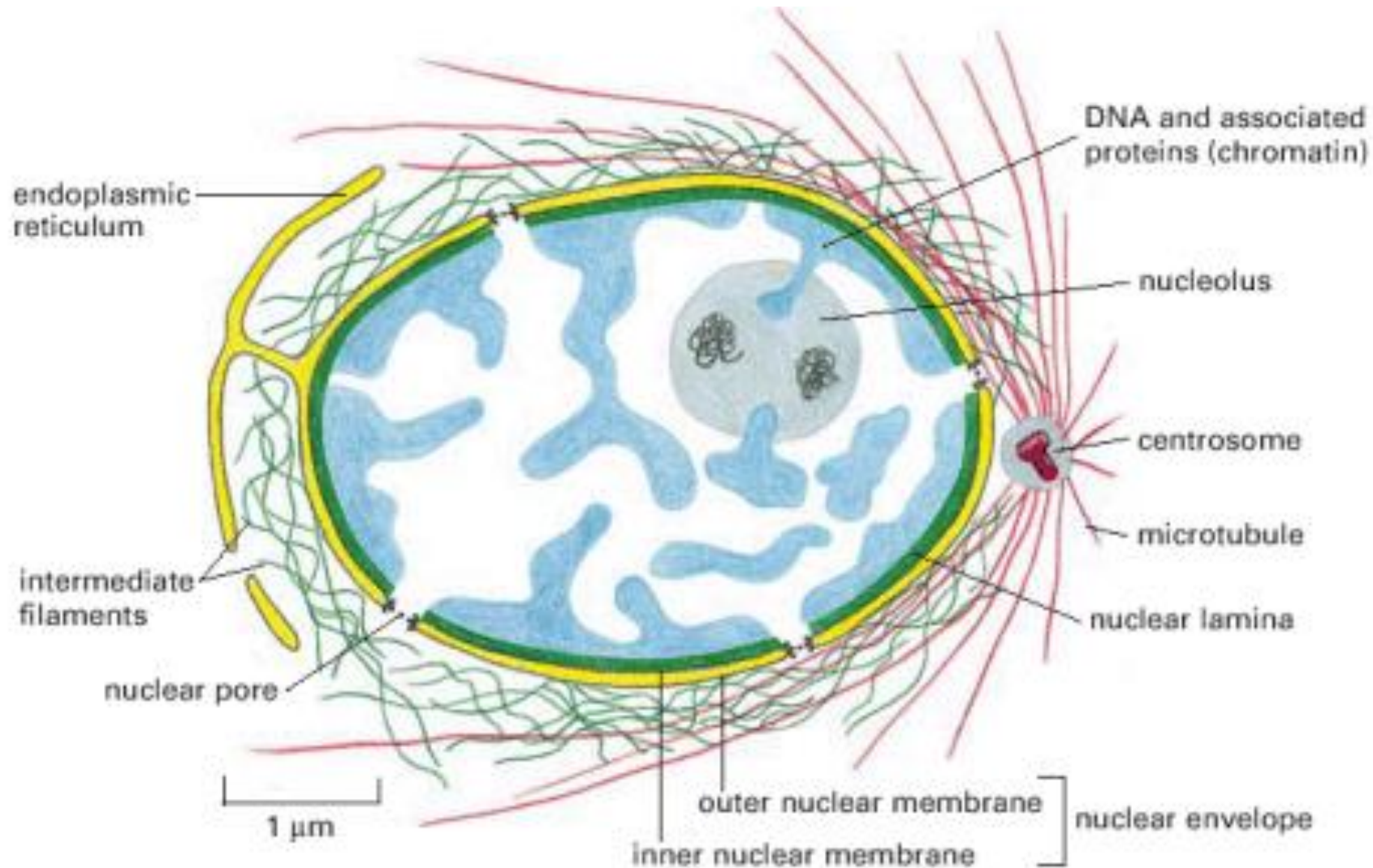


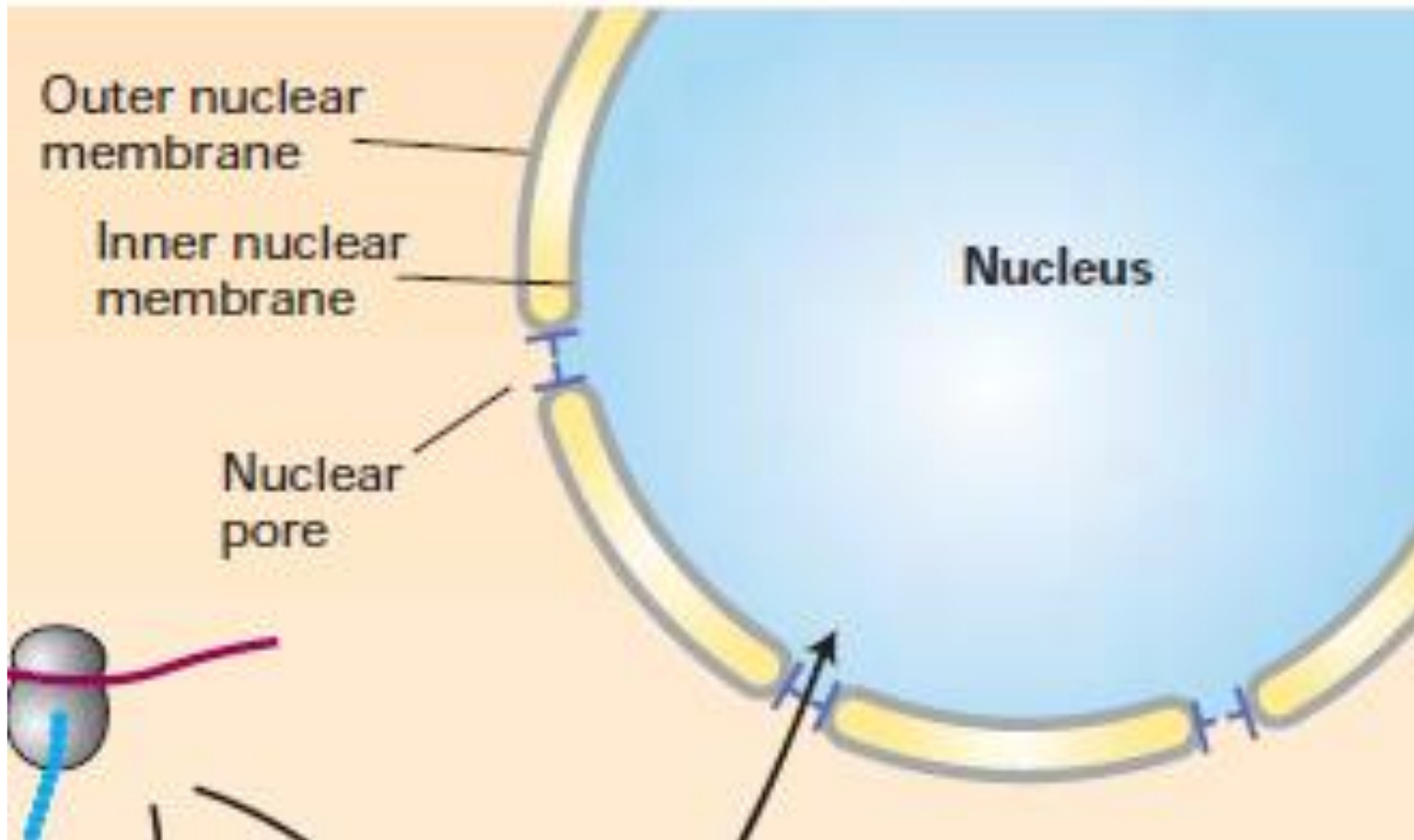
Lecture 8

Nucleus



Nuclear envelope
Nuclear pore
Nuclear lamina
Nucleoplasm
Chromatin
Nucleolus

Nuclear envelope



The critical function of the nuclear membranes is to act as a barrier that separates the contents of the nucleus from the cytoplasm.

The outer nuclear membrane is continuous with the endoplasmic reticulum, so the space between the inner and outer nuclear membranes is directly connected with the lumen of the ER

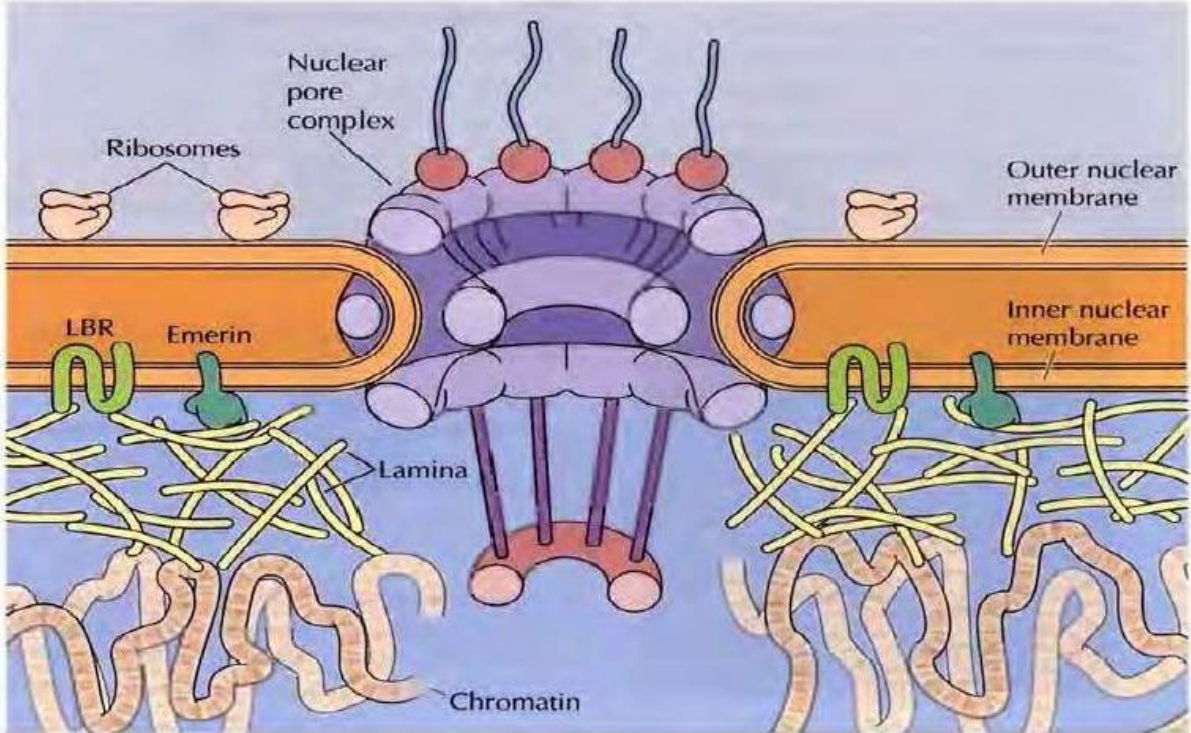
Nuclear lamina

It is a fibrous meshwork that provides structural support to the nucleus envelope

Nuclear lamina is composed of fibrous proteins called lamins

Lamins are a class of intermediate filament proteins

Mammalian cells have three lamin genes, designated A, B, and C, which code for at least seven distinct proteins.

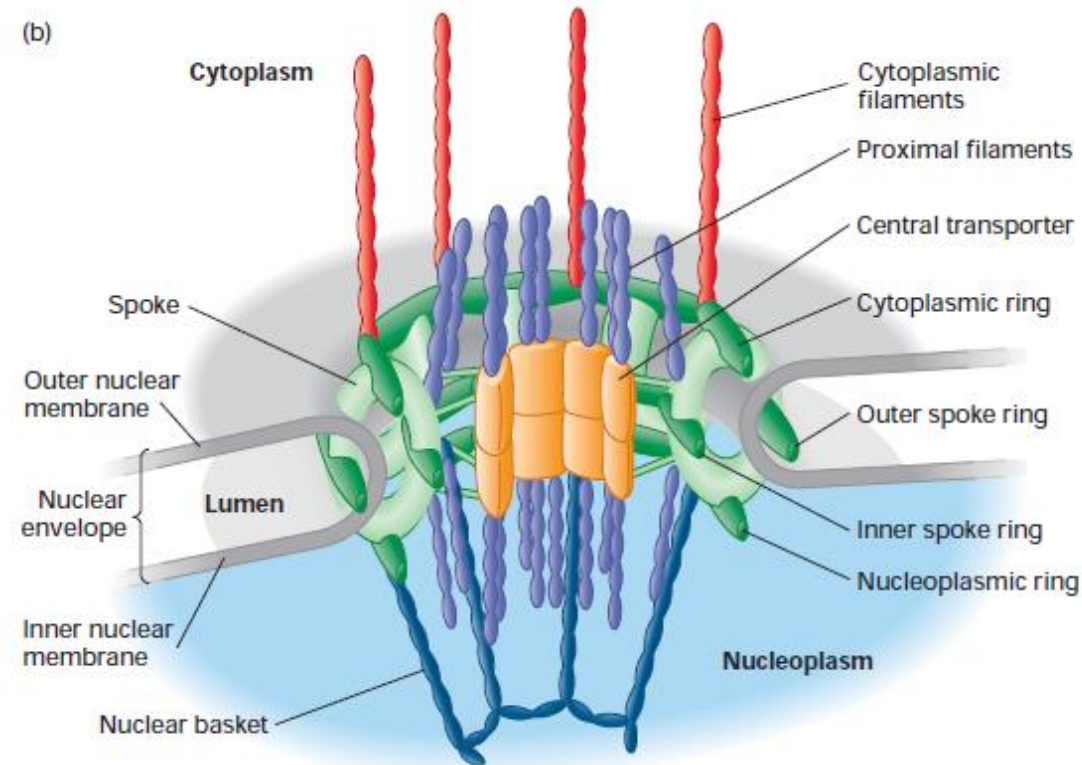


Nuclear pore complex (NPC),

Numerous pores perforate the nuclear envelope in all eukaryotic cells.

Each nuclear pore is formed from an elaborate structure termed the **nuclear pore complex (NPC)**, which is immense by molecular standards, ≈ 125 million daltons in vertebrates, or about 30 times larger than a ribosome.

An NPC is made up of multiple copies of some 50 (in yeast) to 100 (in vertebrates) different proteins called **nucleoporins**.



Nuclear localization signal (NLS)

All proteins found in the nucleus are synthesized in the cytoplasm and imported into the nucleus through nuclear pore complexes.

Such proteins contain a *nuclear-localization signal (NLS)* that directs their selective transport into the nucleus.

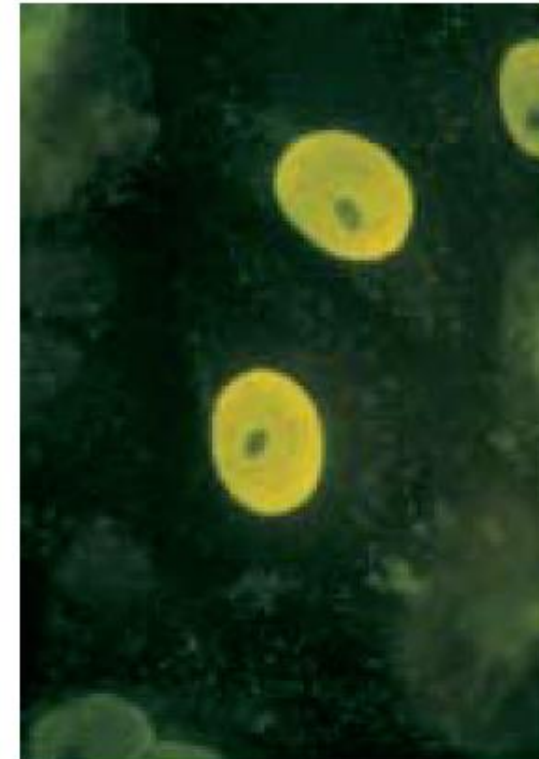
The first NLS to be discovered was the sequence PKKKRKV in the SV40 Large T-antigen (a monopartite NLS)

Bipartite – two clusters of basic amino acid residues separated by a spacer

(a)



(b)



Nuclear localization signal (NLS)

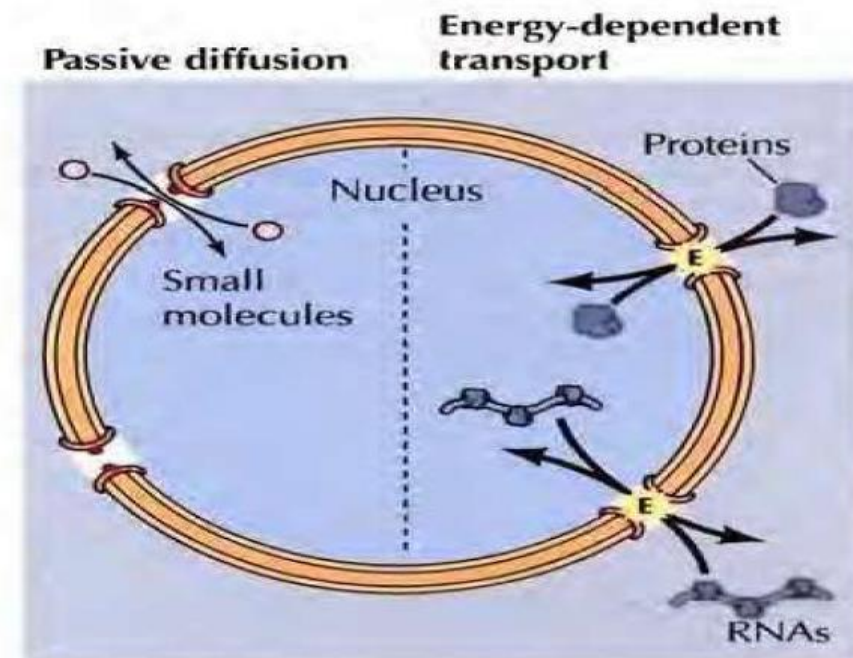
Recognition of nuclear localization signal

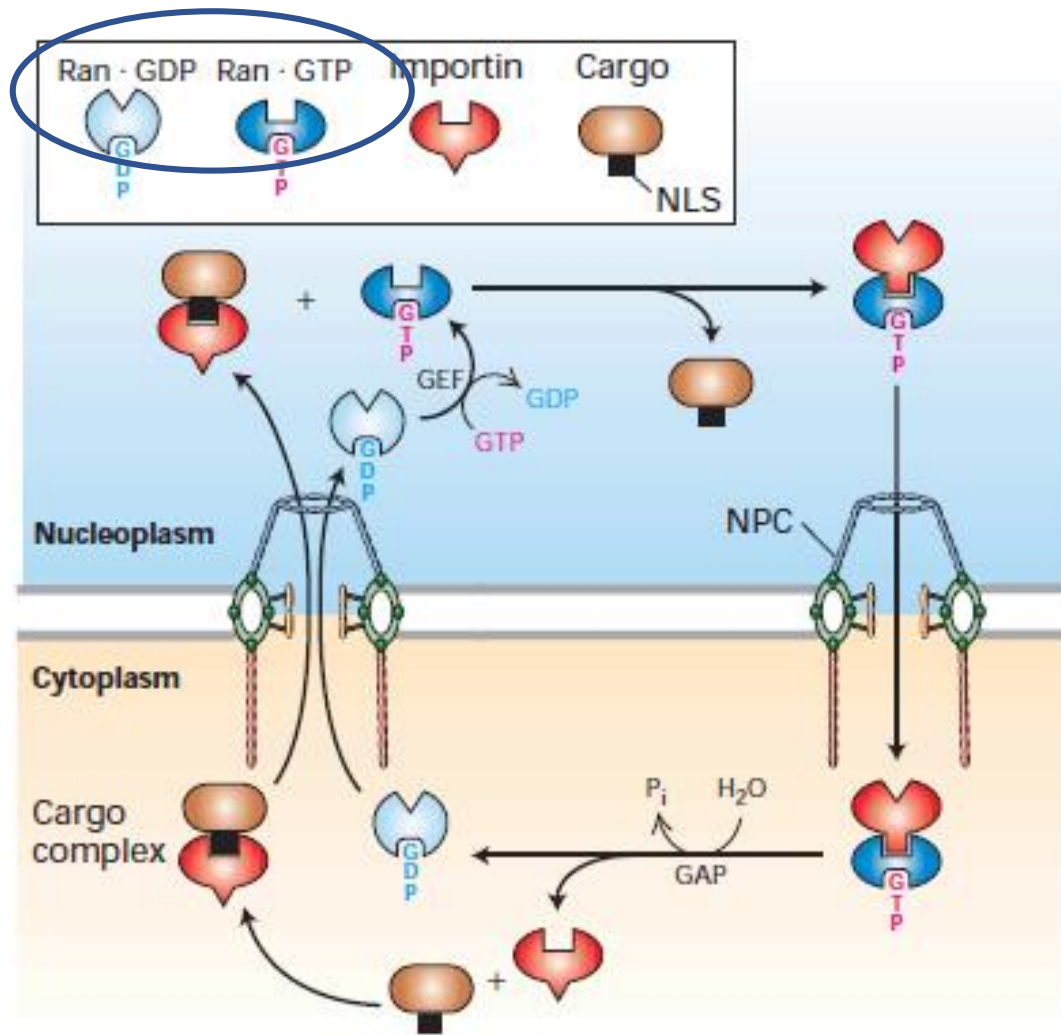
NLS are recognized by proteins that function as nuclear transport receptors.

Most of the Nuclear transport receptors are members of the **karyopherin** protein family

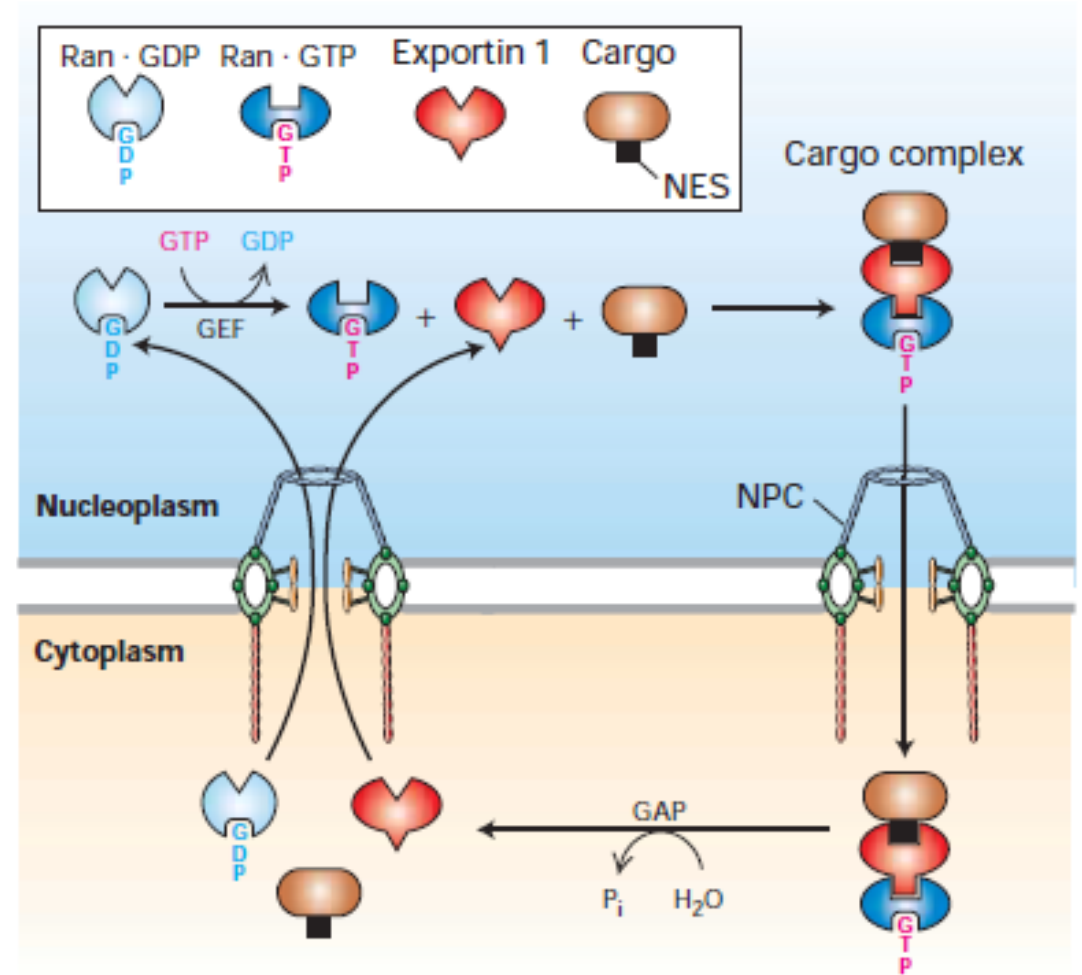
Karyopherins are a group of proteins involved in transporting molecules between the cytoplasm and the nucleus of a eukaryotic cell

They are of two types: importins and exportins





Import



Export

Internal structure of Nucleus

- Nucleoplasm
- Nucleolus
- Chromosomes

Nucleolus

The space between the nuclear envelope and nucleolus is filled by transparent, semisolid granular and slightly acidophilic ground substance or matrix known as **nucleoplasm or karyolymph**

Chromatin thread and nucleolus remain suspended in it.

It contains mainly the nucleoproteins but also contains nucleic acids, proteins enzymes and minerals

Chromatin

The extent of chromatin condensation varies during the life cycle of the cell

In interphase (nondividing) cells, most of the chromatin called **euchromatin** which is relatively decondensed form and distributed throughout the nucleus

During this period of the cell cycle, genes are transcribed and the DNA is replicated in preparation for cell division

In contrast to **euchromatin** about 10% of interphase chromatin called **heterochromatin** is in a very highly condensed state that resembles the chromatin of cells undergoing mitosis

- Heterochromatin is **transcriptionally inactive** and contains highly repeated DNA sequences, such as those present at centromeres and telomeres

Types of heterochromatin

- Constitutive heterochromatin - More stable, Permanent factor of a particular cell type
- Facultative heterochromatin – Reversible, Not a permanent factor

