

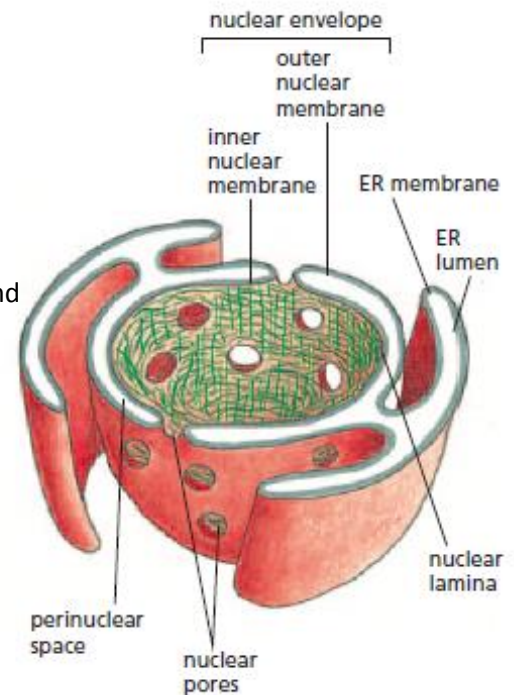
Importing Proteins to membrane-enclosed organelles:

- Via nuclear pores
- Via membranes
- Via vesicles

Signal sequence (about 15-60 amino acids in length) often (but not always) is removed by a signal peptidase once the protein reaches its destination.

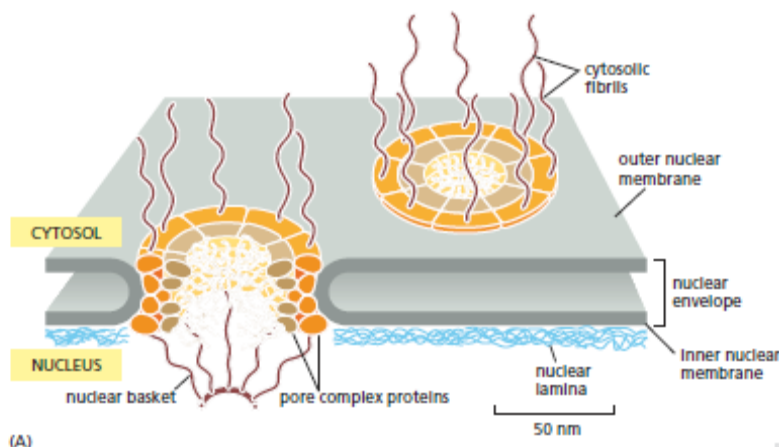
Nuclear Envelope:

- Two membranes, continuous with endoplasmic reticulum
- Inner membrane has nuclear lamina, that gives structure
- Outer membrane continuous with endoplasmic reticulum; both have ribosomes (engaged in protein synthesis)
- Those proteins are transported into the space between inner and outer membrane called **perinuclear space** which is continuous with the endoplasmic reticulum **lumen**



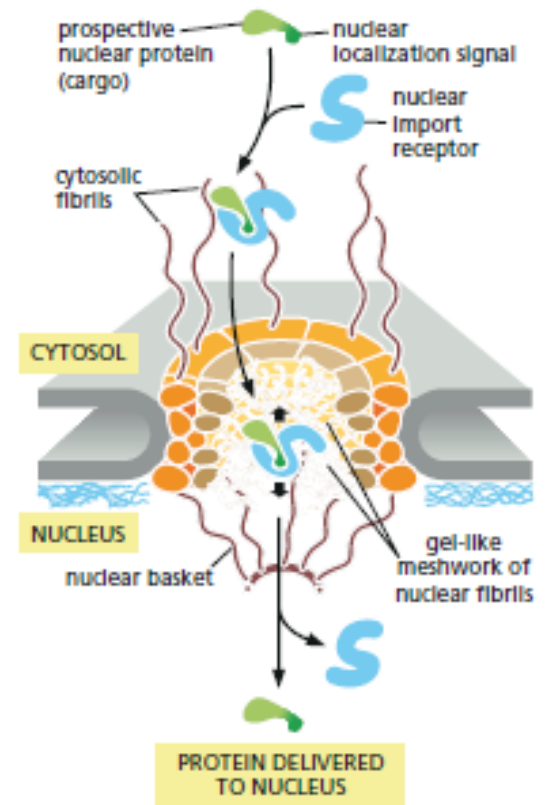
Nuclear Pores:

- Pores perforate the nuclear envelope
- Each pore is formed by a large structure, known as **nuclear pore complex**
- Nuclear → cytosolic traffic includes tRNA, mRNA
- Cytosol → nucleus includes histones, DNA, RNA polymerases, gene regulatory proteins, RNA-processing proteins.



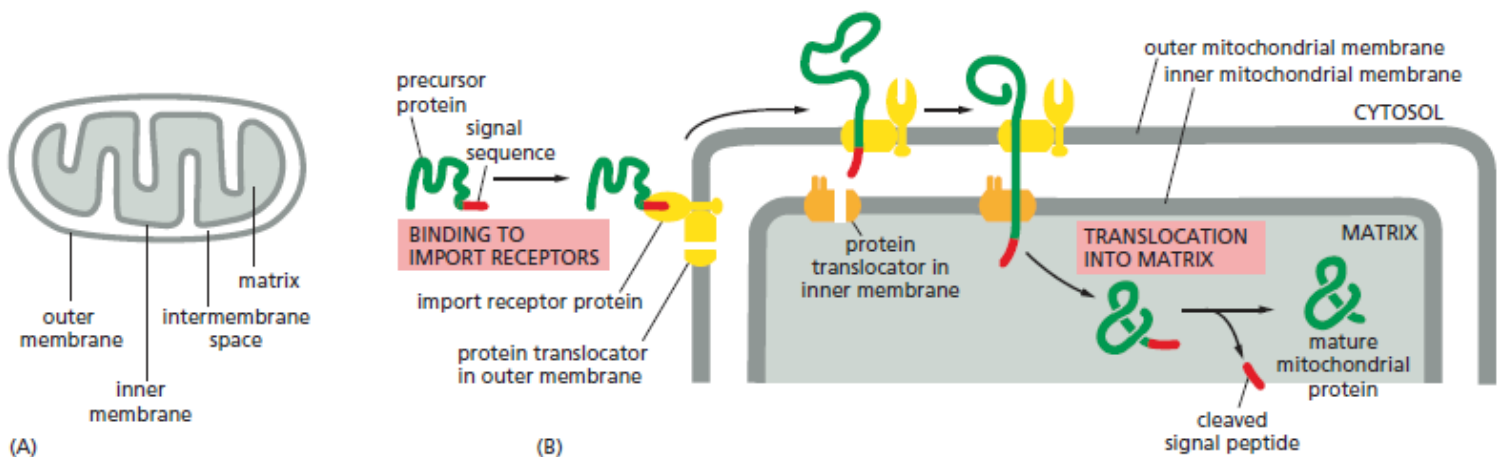
- Proteins enter nucleus via nuclear pore.
- Each pore contains one or more open aqueous channels, which water soluble molecules that are smaller than a certain size can diffuse passively
- Larger molecules (RNA and proteins) cannot pass, unless they have the **nuclear localisation signal** that directs the proteins to the nucleus
- **N.L.S.** generally consists of 4-8 amino acids rich in lysine, arginine and proline

- The **localisation signal** of the prospective nuclear protein (cargo) binds to the **nuclear import proteins** receptor.
- This complex is then attached to cytosolic fibrils of the nuclear pore complex, and transport proteins in their fully folded conformation.
- The complex is then passed through the pore via the gel-like meshwork of the nuclear fibrils.
- Then in the nuclear basket, the protein is delivered to the nucleus, and the nuclear import protein detaches.



Protein Transport into Mitochondria / Endoplasmic Reticulum:

- Both the mitochondria and chloroplast are surrounded by an outer and inner membrane.
- Proteins must be unfolded before they can be imported.



- **Signal sequence** of importing protein binds to **import receptor protein**
- **Import receptor protein** finds **inner membrane protein translocator**
- Both outer and inner **protein translocators** line up; and protein unfolded and translocated in
- Protein is refolded, and the **signal sequence** is cleaved → mature mitochondrial protein
- Chaperone protein aids signal peptidase to break down signal sequence.

