1.2 Proteome

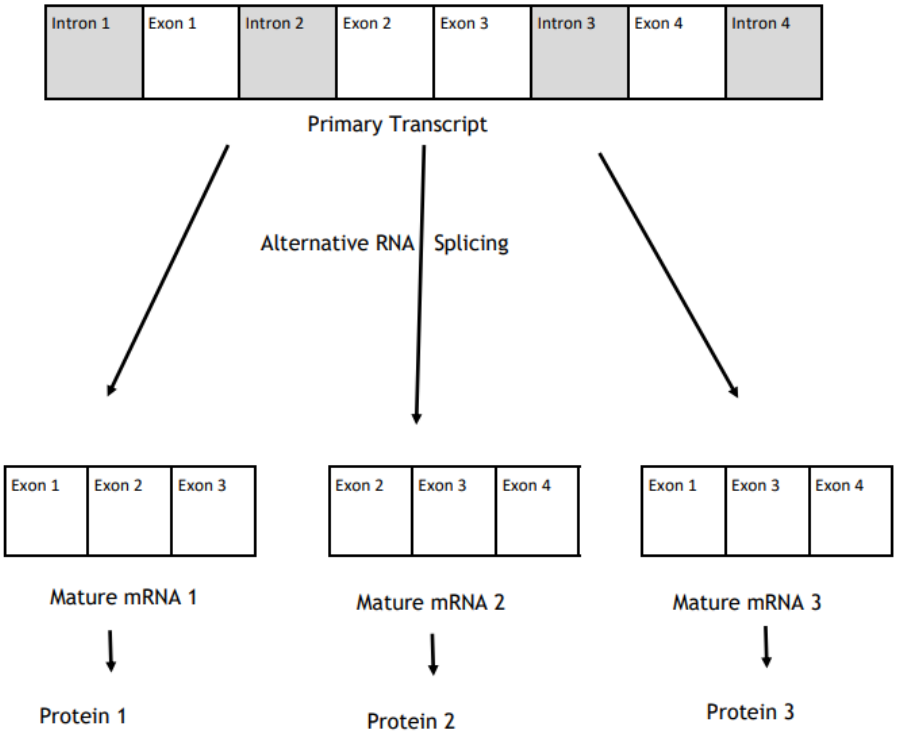
Proteome

Entire set of **proteins** expressed by a genome.

Proteome is larger than the genome particularly in eukaryotes as more than 1 protein produced per gene due to **alternative RNA splicing**.

Alternative RNA splicing

Introns removed and different combinations of exons make different mature mRNA's making different proteins.



The proteome (set of proteins) expressed by a cell can

1. Vary over time
2. Vary under different conditions such as :

    a) metabolic activity of the cell
    b) cellular stress
    c) diseased vs healthy cells
    d) response to signalling molecules

Genome

1. Coding genes for protein
2. Non coding RNA genes (don't code for protein)

Non coding RNA genes

1. Transcribed to produce tRNA & rRNA,
2. Transcribed to RNA molecules that control the expression of other genes.

1.2 Eukaryotic Internal Membranes

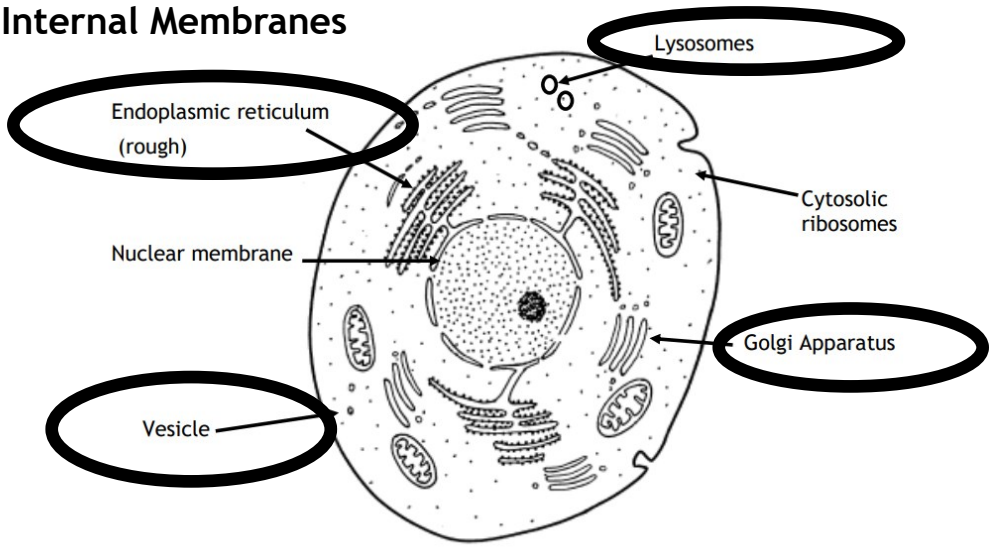
Eukaryotes have a relatively small surface area to volume ratio.

The plasma membrane of eukaryotic cells is therefore too small an area to carry out all the vital functions carried out by membranes.

Solution

System of internal membranes, which increases the total area of membrane

Internal Membranes



1. **Endoplasmic Reticulum**

   Network of membrane tubules continuous with the nuclear membrane.
   Rough ER (RER) has ribosomes on its cytosolic face while SER lacks ribosomes.

   Function
   RER: transports proteins SER: Synthesis of lipids

2. **Vesicles**

   Membrane bound organelle that buds off RER/golgi apparatus.

   Function

   Transports substances between membrane compartments.

3. **Golgi Apparatus**

   Series of flattened membrane discs

   Function

   Post translation modifications: adding carbohydrate OR phosphate to proteins

4. **Lysosomes**

   Membrane-bound organelles containing a variety of hydrolases that digest proteins, lipids, nucleic acids and carbohydrates

1.2 Lipid & Protein synthesis

Lipid Synthesis

Lipids are synthesised in the **smooth endoplasmic reticulum** (SER) and inserted in to its **membrane.**

Types of Proteins

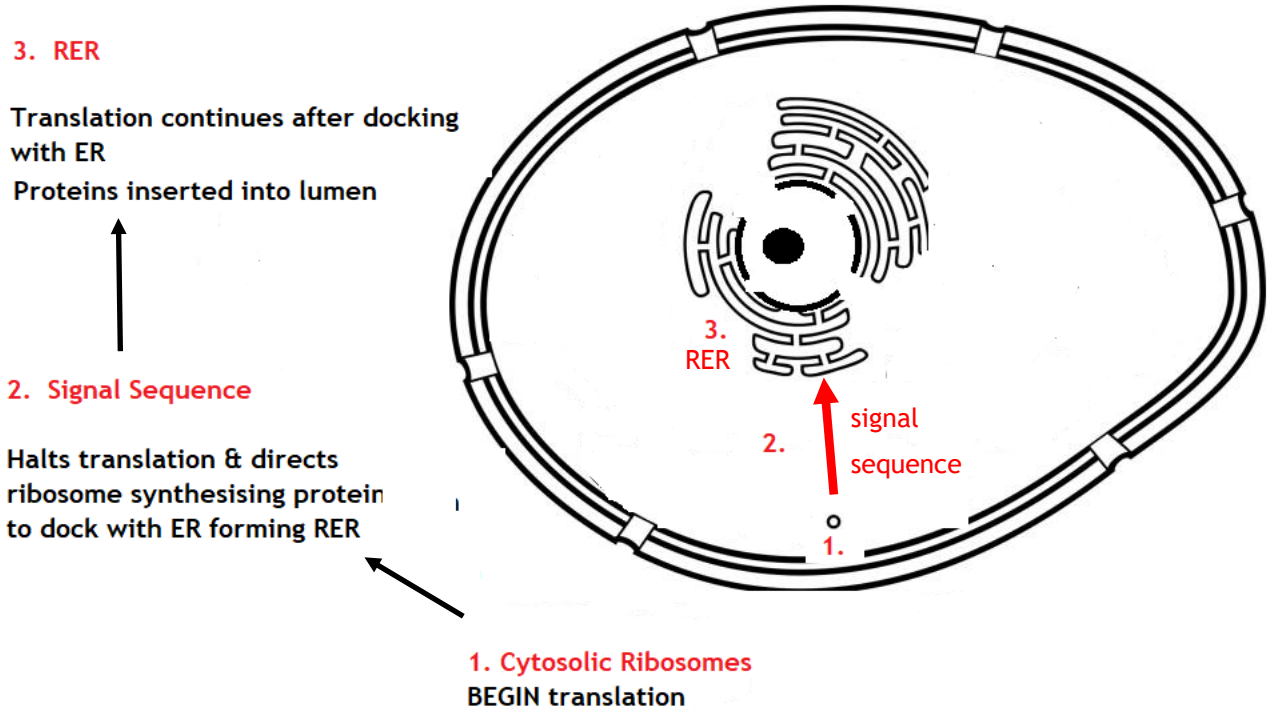
1. **Cytosolic proteins:**
   Proteins remain in cytosol after synthesis

   Begin synthesis = cytosolic ribosomes Finish synthesis = cytosolic ribosomes

2. **Transmembrane proteins**
   Begin synthesis = cytosolic ribosomes Finish synthesis = ribosomes docked on RER

Stage 1 : Protein synthesis

1. Begin synthesis in **cytosolic ribosomes.**
2. Carry a **signal sequence**, which halts translation and directs the ribosome synthesising the protein to dock with the ER, **forming RER.**
3. Translation continues after docking, and the protein is **inserted** into the membrane (lumen) of the RER



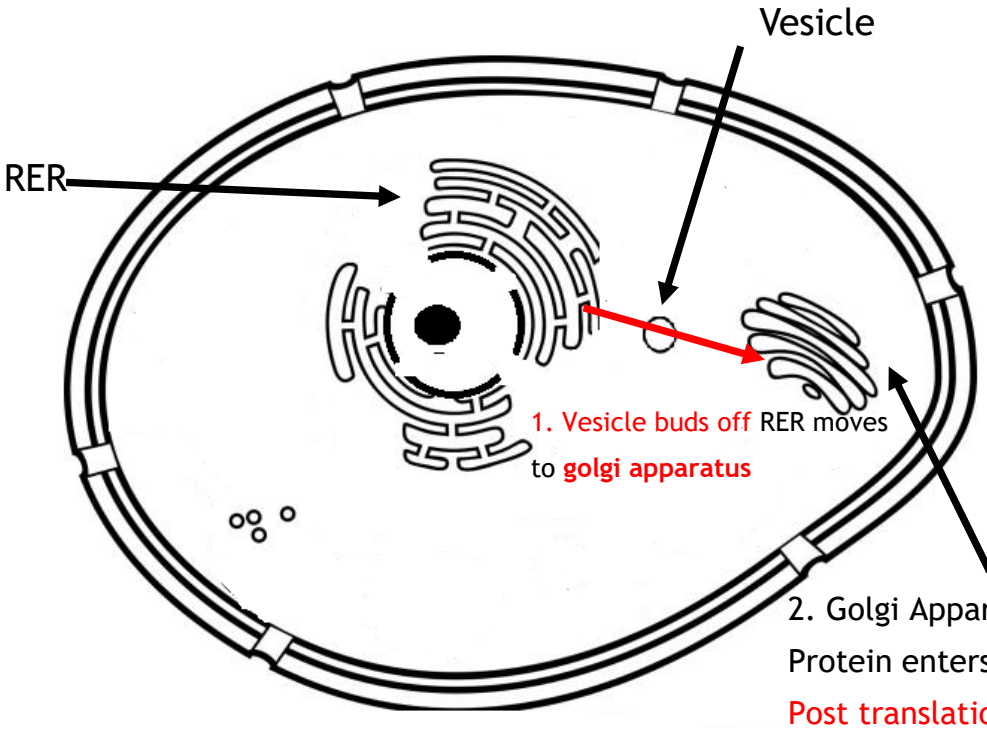
1.2 Protein synthesis

Stage 2: Movement to Golgi Apparatus

Once inside the ER, **vesicles** that bud off from the ER and fuse with the Golgi apparatus.

As proteins move through the Golgi apparatus, further **vesicles bud off** from one disc and fuse to the next one in the stack.

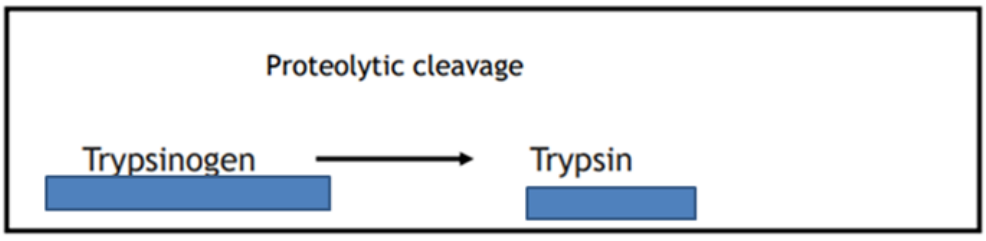
Enzymes in the golgi catalyse the addition of various sugars in multiple steps to **add a carbohydrate** to the protein as they undergo **post-translational modifications**



Proteolytic cleavage

Many secreted proteins are synthesised as **inactive precursors** and require proteolytic Cleavage to produce **active proteins**.

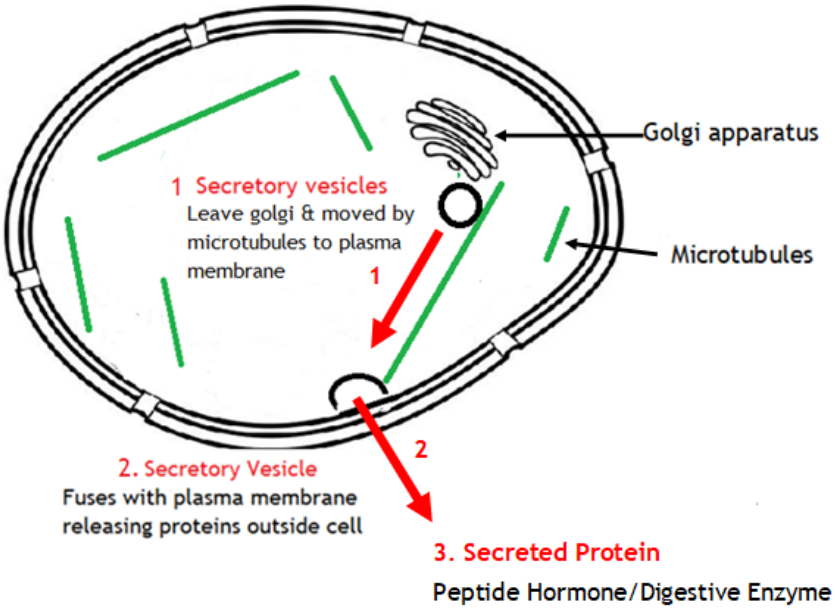
Proteolytic cleavage is another type of **post- translational modification**.



1.2 Protein synthesis

Step 3—Movement to plasma membrane/lysosomes

Vesicles that leave the Golgi apparatus move along **microtubules** to the **plasma membrane and lysosomes**.

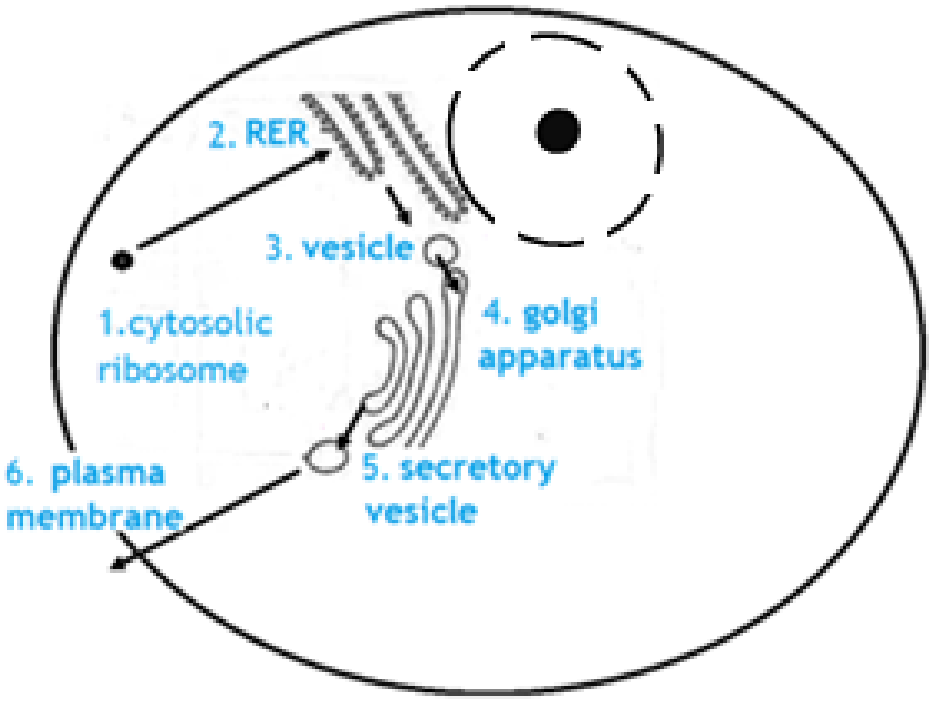


Secreted Protein Summary

1. Translation begins on cytosolic ribosomes
2. A signal sequence on protein halts translation & directs protein to dock with ER forming RER.
3. Translation continues at ribosome after docking with ER.
4. Protein enter into RER lumen after translation is complete.
5. RER transports protein
6. A vesicle buds off RER and moves protein to golgi apparatus
7. Golgi apparatus inserts protein into its lumen & protein moves through.
8. Post translational modifications occur such as adding carbohydrate OR phosphate OR proteolytic cleavage
9. Proteolytic cleavage involves turning inactive precursors into active proteins
10. Porteins packaged into a secretory vesicle leaves golgi and is moved by microtubles to plasma membrane
11. Vesicle fuses with plasma membrane releasing protein outside cell
12. Secretory proteins include peptide hormones or digestive enzymes

1.2 Protein synthesis

Secreted Protein Route Summary



Cytosolic Ribosomes
↓
RER
↓
Vesicle
↓
Golgi apparatus
↓
Secretory vesicle
↓