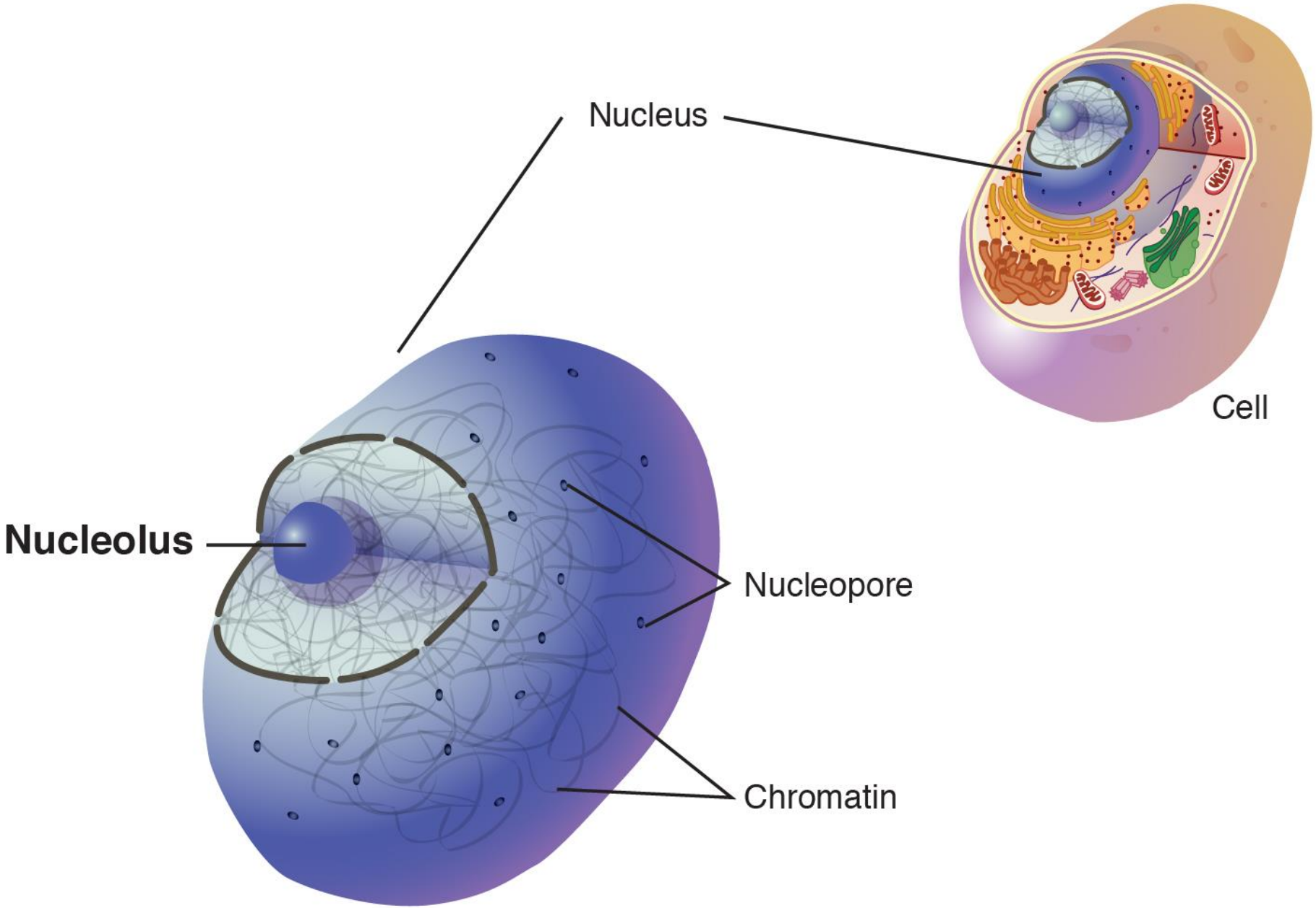
Nucleolus

- The nucleolus is a region found within the cell nucleus that is concerned with producing and assembling the cell's ribosomes.
- Usually they can be found in the central nuclear region but may also be close to the nuclear membrane.
- A nucleolus is built by a nucleolus organizing region (NOR) of a specific chromosome.
- Function: Main function is ribosomal RNA (rRNA) synthesis and ribosome biogenesis.
- Following assembly, ribosomes are transported to the cell cytoplasm where they serve as the sites for protein synthesis.


Nucleus
Cell
Nucleolus
Nucleopore
Chromatin

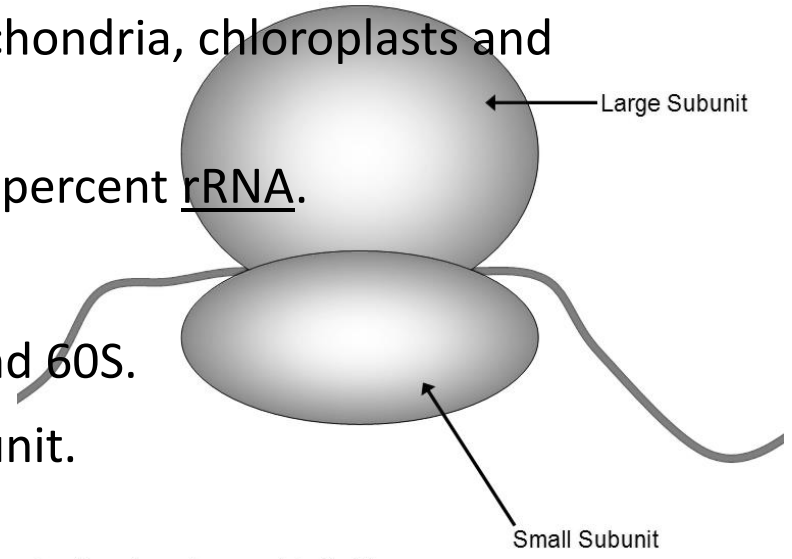
Nucleolus

- Nucleolus is a very specific part inside the cell nucleus.
- This does not contain the chromosomes.
- It contains the machinery necessary to assemble the cell's ribosomal RNAs.
- Ribosomal RNAs then are transported through the nuclear pores into the cytoplasm where they become part of the ribosome, which is the protein machinery.
- These ribosomal RNAs guide the messenger RNAs through the ribosomes and help in the protein translation, but they themselves are RNA's that do not become proteins.
- They're non-coding RNAs that help the messenger RNAs to undergo the protein translation process.
- These RNAs, like the other messenger RNAs, are made in the nucleus, but ribosomal RNAs are made in the nucleolus.

Ribosome

A ribosome is a cell organelle. It functions as a micro-machine for making proteins. Ribosomes are composed of special proteins and nucleic acids

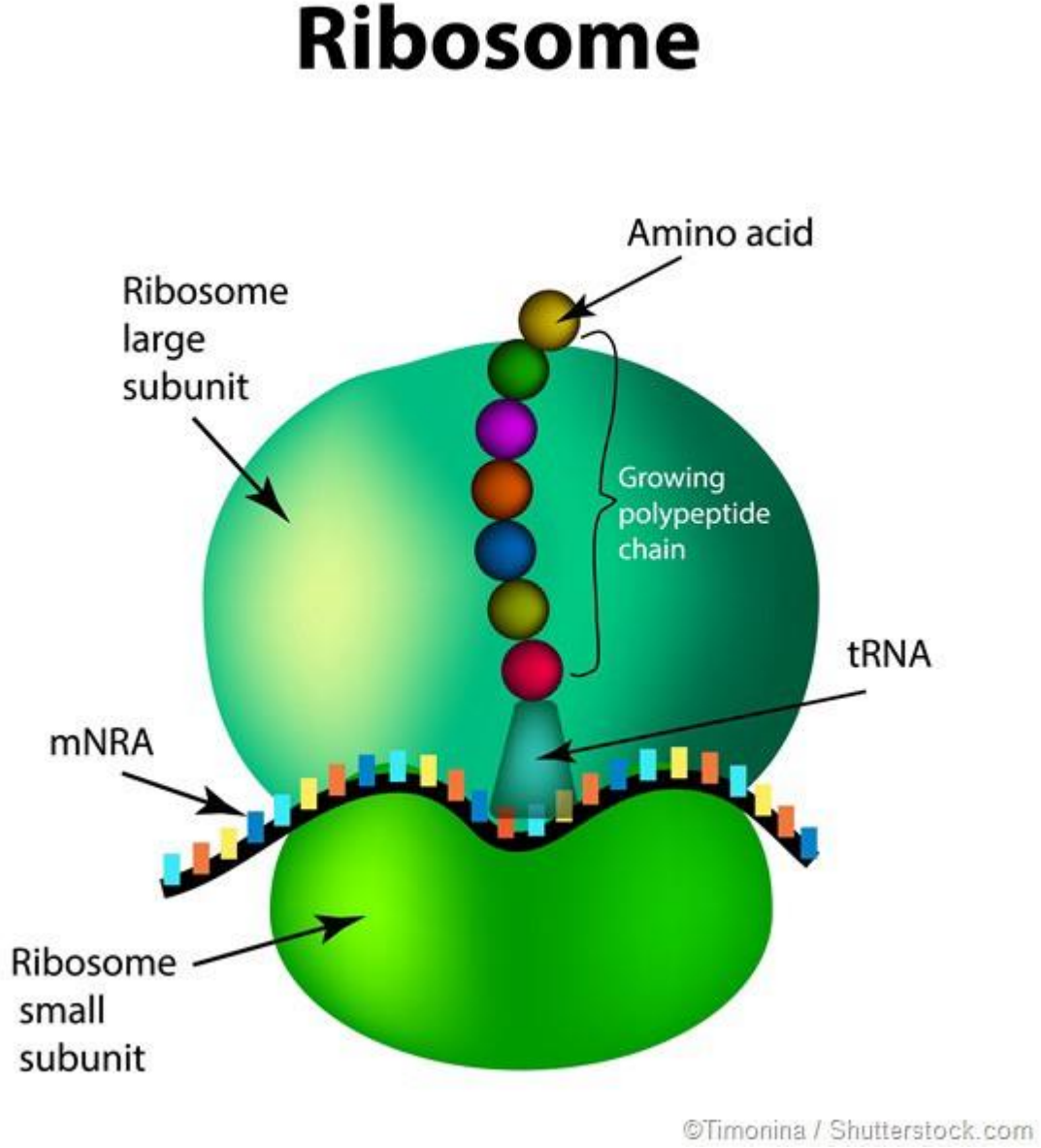
- Each ribosome is composed of two subunits, a larger one and a smaller one, each of which has a characteristic shape.
- The subunits typically are referred to in terms of their sedimentation rate, which is measured in Svedberg units (S), in a centrifugal field.
- Ribosomes are found in prokaryotic and eukaryotic cells; in mitochondria, chloroplasts and bacteria.
- In prokaryotes, ribosomes are roughly 40 percent protein and 60 percent rRNA.
- In eukaryotes, ribosomes are about half protein and half rRNA.
- The small and large subunits of eukaryotes are designated 40S and 60S.
- The prokaryotes contain a small 30S subunit and a large 50S subunit.



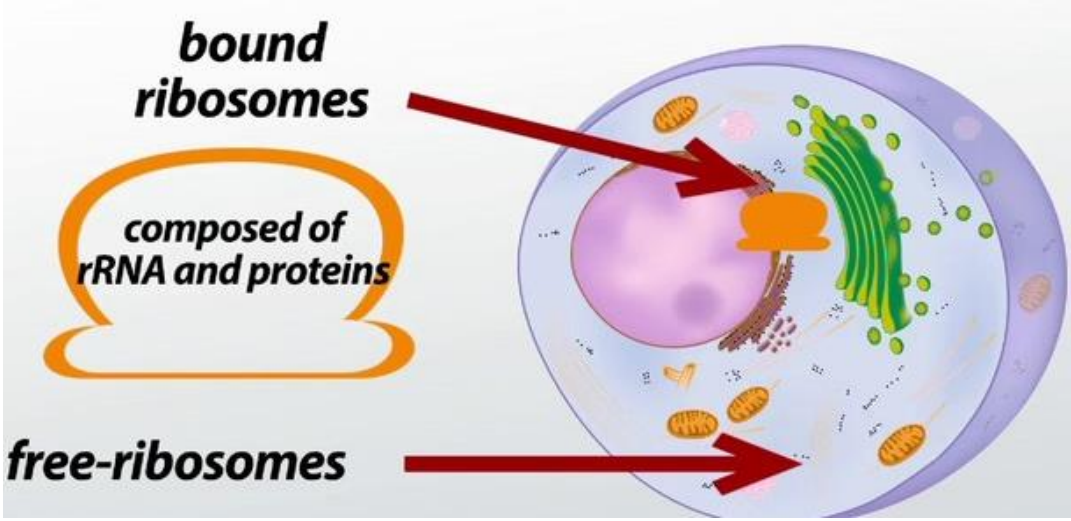
Ribosome

- The ribosome is a complex molecule made of ribosomal RNA molecules and proteins that form a factory for protein synthesis in cells.
- In 1955, George E. Palade discovered ribosomes and described them as small particles in the cytoplasm that preferentially associated with the endoplasmic reticulum membrane.
- Along with other scientists, Palade discovered that ribosomes performed protein synthesis in cells, and he was awarded the Nobel Prize in 1974 for his work.
- Structure: made of RNA and proteins-
  - Each ribosome has a large component and a small component that together form a single unit composed of several ribosomal RNA molecules and dozens of proteins.
- Function: read m RNA and synthesize proteins-
  - The ribosome is responsible for translating encoded messages from messenger RNA molecules to synthesize proteins from amino acids.

- The ribosome translates each codon, or set of three nucleotides, of the mRNA template and matches it with the appropriate amino acid in a process called translation.
- The amino acid is provided by a transfer RNA (tRNA) molecule. Each newly translated amino acid is then added to the growing protein chain until the ribosome completes the process of protein synthesis.
- Export the polypeptide produced to the cytoplasm where it will form a functional protein.



Ribosome



- Ribosomes are found ‘free’ in the cytoplasm or bound to the endoplasmic reticulum (ER) to form rough ER.
- Free cytoplasmic ribosomes code for the proteins to be used inside the cell.
- Endoplasmic ribosome code for the proteins to be used outside the cell.
- In a mammalian cell there can be around 10 million ribosomes.
- Several ribosomes can be attached to the same mRNA strand, this structure is called a polysome.
- Ribosomes have only a temporary existence. When they have synthesised a polypeptide the two sub-units separate and are either re-used or broken up.
- Ribosomes can join up amino acids at a rate of 200 per minute.
- Small proteins can therefore be made fairly quickly but two to three hours are needed for larger proteins such as the massive 30,000 amino acid muscle protein titin.