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**Paper : III , Group – A**

**Topic: Ribosome**

### **Ribosome**

- In 1952 G.E Palade described the ribosome .
- R.B Roberts coined the name ribosome due to rich RNA content.

### **Distribution:**

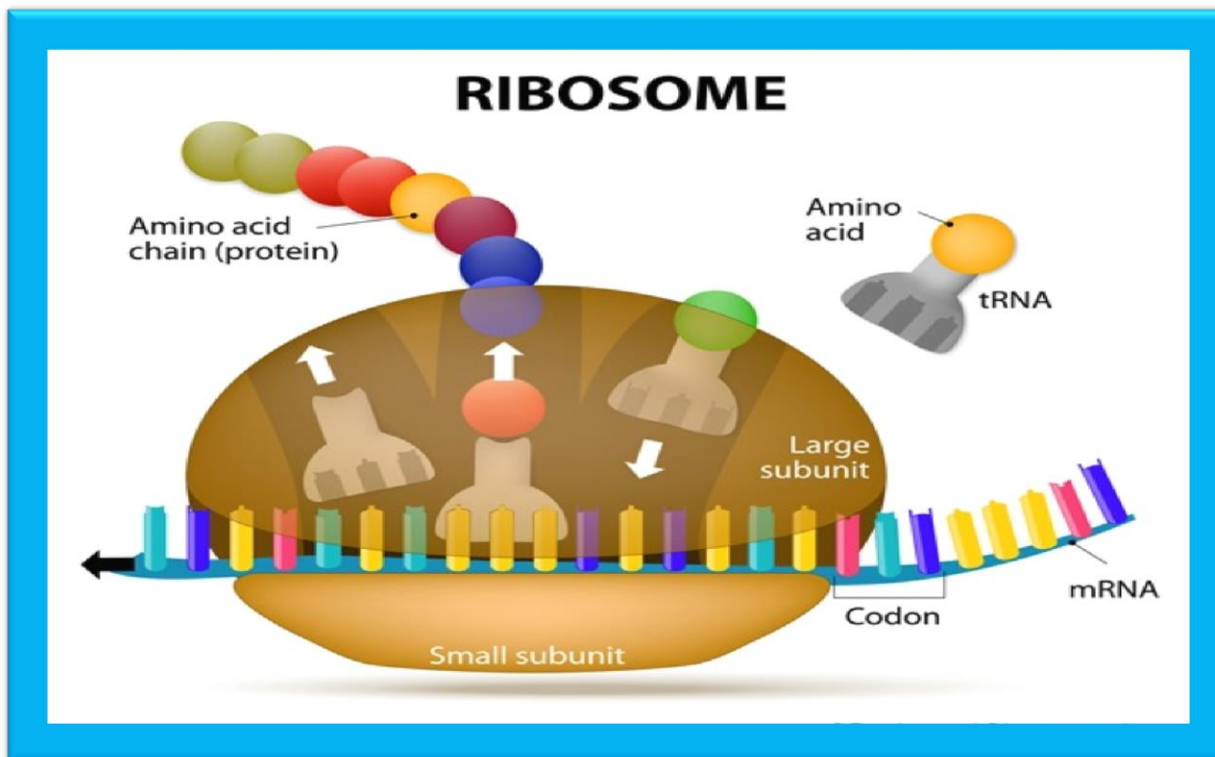
- Presents in all cells (both prokaryotes & Eukaryotes)
- In prokaryotes – freely in cytoplasm.
- In eukaryotes – either in cytoplasm or remain attached to the outer surface of the membrane of E.R.
- The yeast cells, reticulocytes or lymphocytes , meristematic plant tissues, embryonic nerve cells and cancerous cells contain large number of ribosomes, the ribosomes remain attached with the membranes of the E.R.
- Absent in mature RBC of mammals.
- Isolation – by differential centrifugation.

### Structure and types:-

- It is a spherical particle of 150 to 250A° diameter.
- Each ribosome comprises 2 – subunits one is large and another is smaller.
- It is identified by sedimentation coefficient or Svedberg unit.
- In eukaryotes it is of 80 s and 70s in prokaryotes.
- In absence of  $Mg^{2+}$  there ribosomes dissociate into 40s , 60s and 30s , 50s subunits respectively.
- 70s subunit of prokaryotes are comparatively smaller in size and has mol.wt  $2.7 \times 10^6$  daltons.
- Its RNA / Protein ratio = 2:1
- 70s ribosome contains 3 types of rRNA of 16s, 5s and 23s.
- Small subunit contains 16s rRNA and 21 types of protein .
- 16s (1650 nucleotides) 5s (120)
- Large subunit contains 23s and 5 s rRNA and 34 proteins (L1 to L34) 23s (3300 nucleotides).
- Dimension of 70s Ribosome- 170 x 170 x 200A°
- Occurs in – mitochondria, chloroplasts.
- Protein / RNA ratio in 80s = 1:1
- Mol. Wt =  $14 \times 10^6$  daltons.
- It contain 4 types of rRNA – 28s, 18s ,5.8s and 5s.
- Smaller subunit contains (40s) – 18s rRNA and 30 proteins.
- Larger subunits (60s) has 5s, 5.8s and 28s rRNA and 40 proteins.
- Metallic ions of Mg, Ca, Na and Cu are commonly associated .
- These ions are helpful in dissociation and association of subunits.

### Ultra structure:-

- To describe its ultra structure various model was proposed.
  - I. Stoffer & Wittmann's model (Quasi – symmetrical 1977) – bipartite structure. 30s subunit has- head (smaller) and larger body. 50s subunit showed various shapes – frontal – maple leaf, lateral kidney. It appears bilaterally symmetrical and shows 3 protuberances.
    - II. Lake's model (Asymmetrical model 1981)
      - Smaller subunit has a head, base and a platform .Head is separated from platform by a cleft (site of codon and anticodon).
      - Larger subunit consists of a ridge , a central protuberance and a stalk.
    - III. 3- D mode of 80s
      - 40s subunit is similar to 30s subunit . It is divided into head and base segments by a transverse groove.
      - 60s – one side is flattened similar to 50s.



**Fig: Ribosome**

**Chemical composition:**

- 70s – contain 60 to 40% rRNA and 36 to 37% protein.
- There is no lipid content in ribosome.
- In 80s 60% of rRNA is helical (double stranded) and contain paired bases due to hairpin loops between complimentary regions of the linear mole.
- 28s - mol.wt-  $106 \times 10^6$  dit double straded.
- 18s – mol.wt –  $06 \times 10^6$  dit and 2100 nucleotides.
- 5s – clover leaf structure 120 nucleotides .
- 5.8s – 28 s- associated ribosomal RNA (28s – rRNA)
- In mitochondria 5s rRNA absent ( 21s and 12s rRNA)

**Ribosome protein-**

- 70s – 5s ribosomal proteins
- 80s – 70 ribosomal proteins

**Metallic ions:-**

- Its 1<sup>st</sup> critical level is 0.55 micro molecule and
- 2<sup>nd</sup> critical level is 0.3 micro molecules.
- Below this association of subunits break up in 70s.
- In 80s – 1<sup>st</sup> critical level is 0.3 micro molecules.
- 2<sup>nd</sup> critical level is 0.15 micro molecules.
- At high concentration of Mg<sup>2+</sup> ions in the matrix the two subunits of ribosome become associated with each other known as dimer.
- Further during protein synthesis many ribosomes are aggregated due to common messenger RNA and form the polyribosomes.

**Functions:-** Protein synthesis.

