RIBOSOMES AND VACUOLES

SUBMITTED TO:
BOTANY DEPARTMENT
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B.SC(1st year) SEM-2
ROLL NO. :

DISCOVERY

- Discovered by Robinson and Brown in 1953 in plant cells.
- In animal cells they were discovered by Palade in 1955.
- Palade also coined the term of ribosome

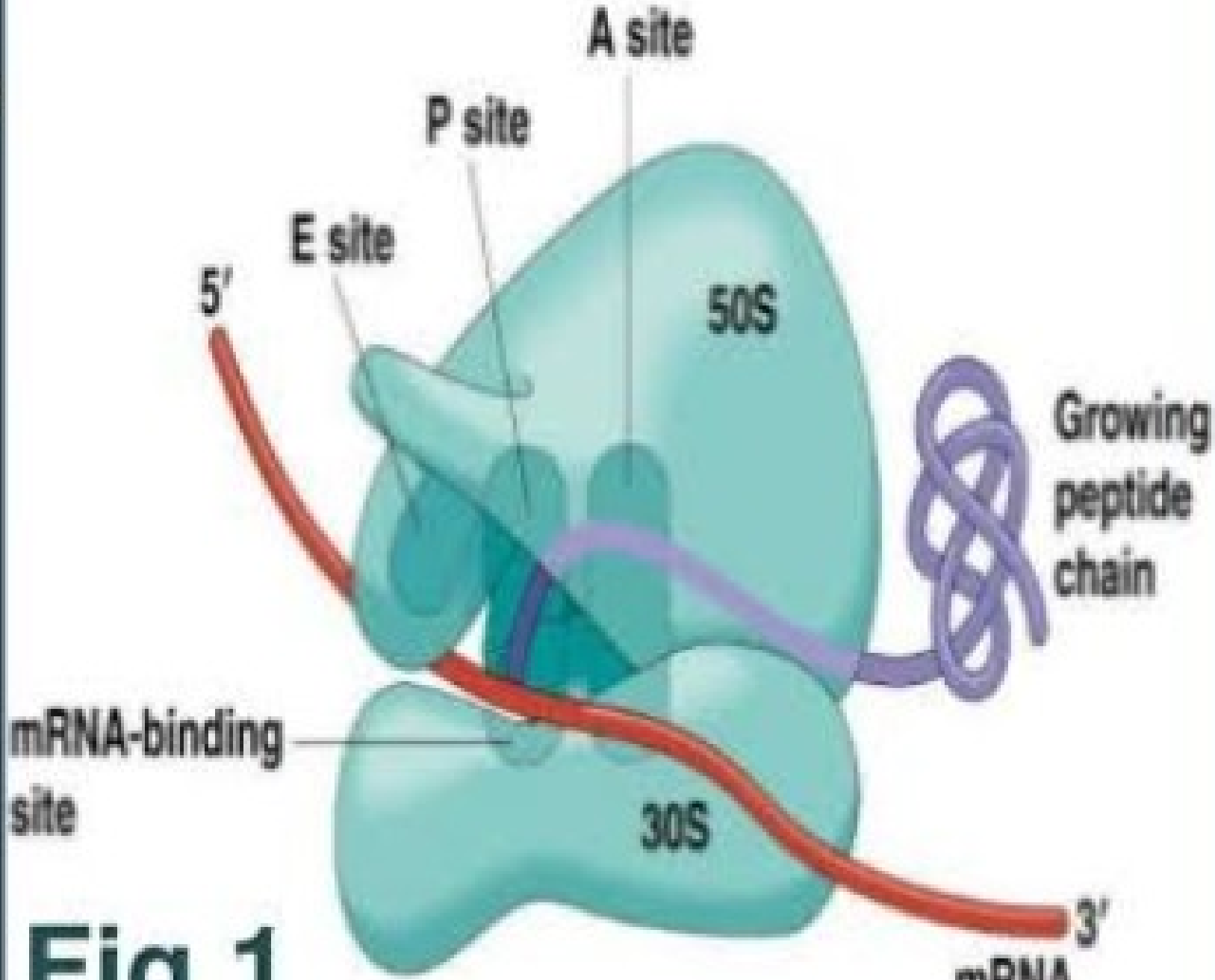
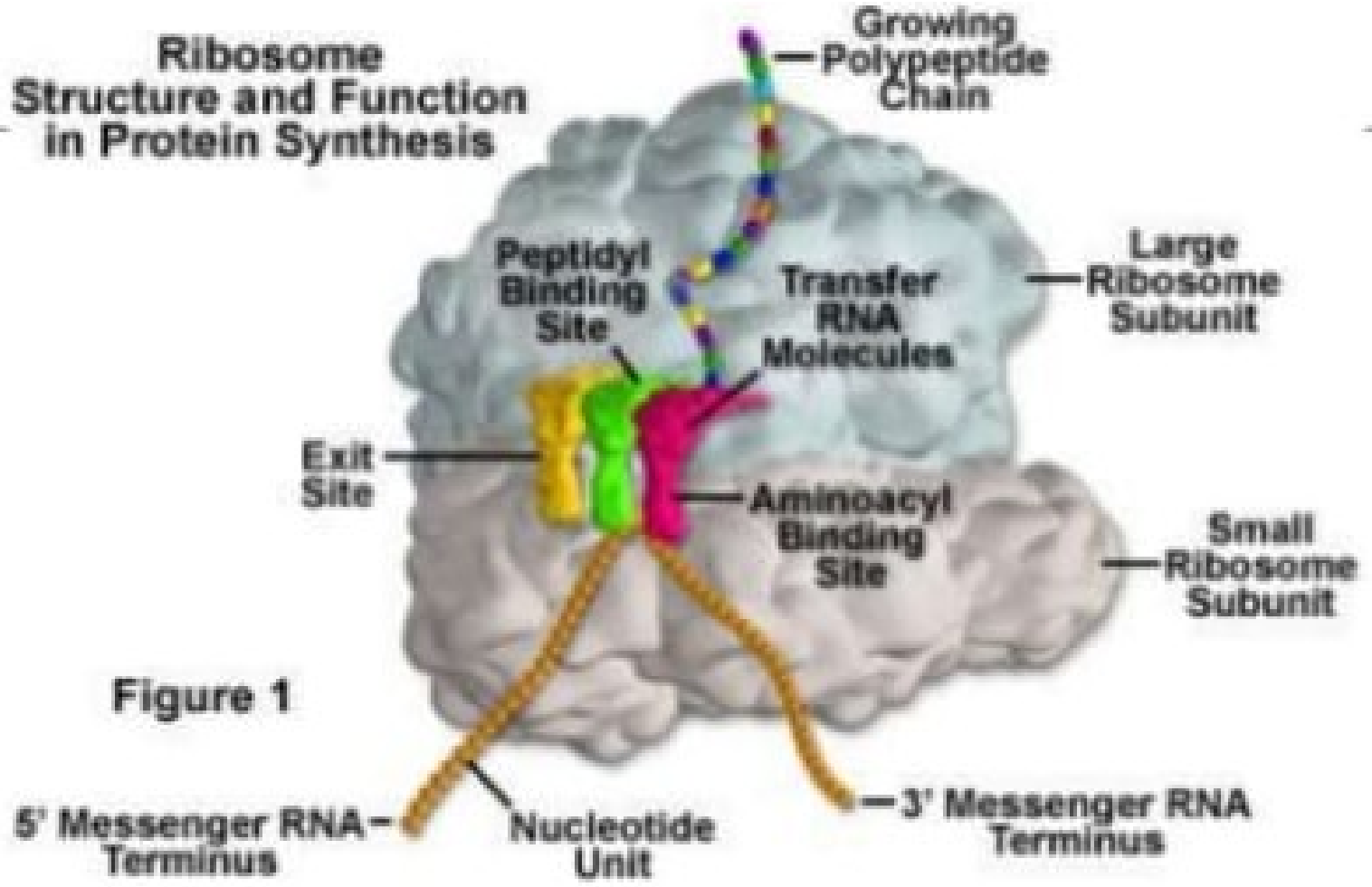

A site
P site
E site
5′
50S
Growing peptide chain
mRNA-binding site
30S
3′
mRNA

Fig 1

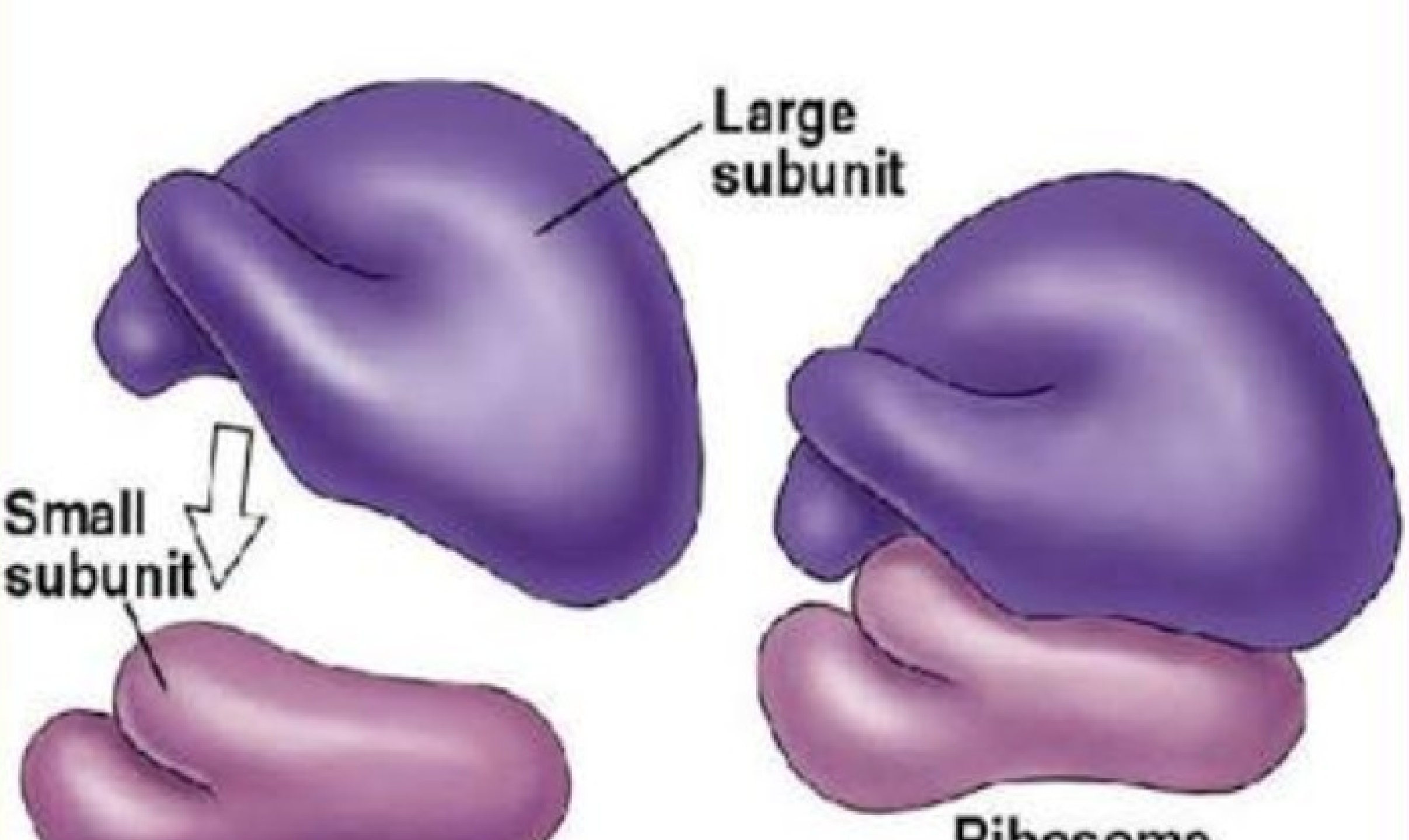
INTRODUCTION

- Ribosomes are naked ribonucleoprotien protoplasmic particles (RNP) .
- They are 200-340 A long and have a diameter of 170-240 A
- They function as the sites of protien and polypeptide synthesis.
- They are popularly known as protien factory.


Ribosome
Structure and Function
in Protein Synthesis
Growing
Polypeptide
Chain
Peptidyl
Binding
Site
Transfer
RNA
Molecules
Large
Ribosome
Subunit
Exit
Site
Aminoacyl
Binding
Site
Small
Ribosome
Subunit
Figure 1
5' Messenger RNA
Terminus
Nucleotide
Unit
3' Messenger RNA
Terminus

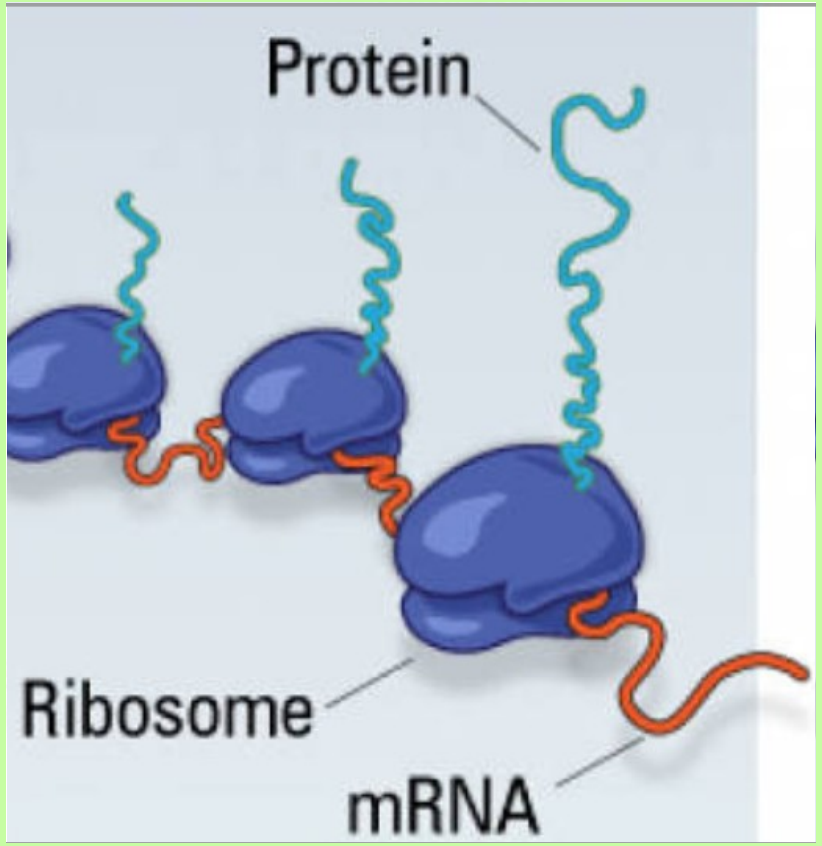
STRUCTURE

- Ribosomes are subspherical in outline. A covering membrane is absent.
- Each ribosome consist consists of two consists of two unequal subunits : largest dome shaped and smaller ellipsoid.
- The larger subunit has protuberance,a rigid and a stalk from its upper side and flattened area on one surface.
- The smller subunit is elongated with a platform, cleft and base. Its about half of the larger subunit


Large subunit
Small subunit
Ribosome

LOCATION

- They may simply occur as **monosomes** or in rosettes or helical groups called **polyribosome** or **polysomes.**
- They different ribosomes of polysomes are connected with a thick strand of messenger or **mRNA.**
- The maintainance of polyribosomes requires energy.
- Ribosomes occur in all living cells with the exception of **mammalian erythrocytes** or **red blood corpuscles**



TYPES OF RIBOSOMES

Depending upon their place of occurence ribosomes are of two types :

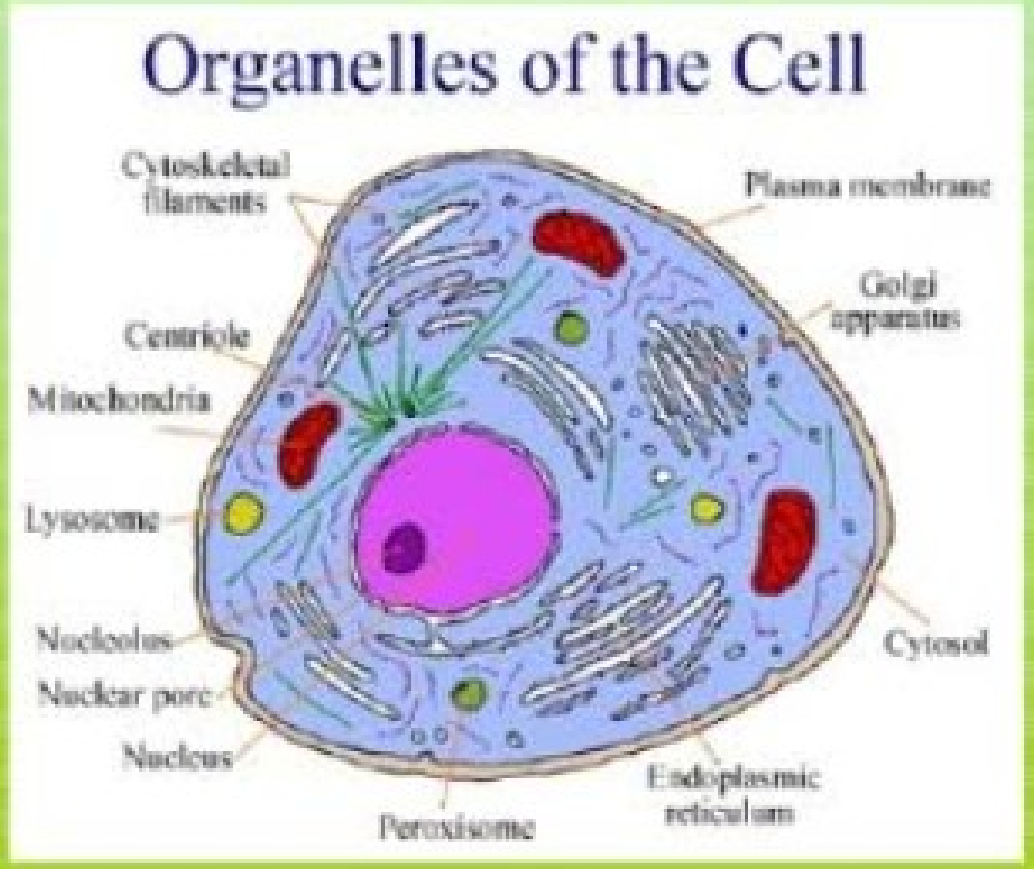
CYTOPLASMIC

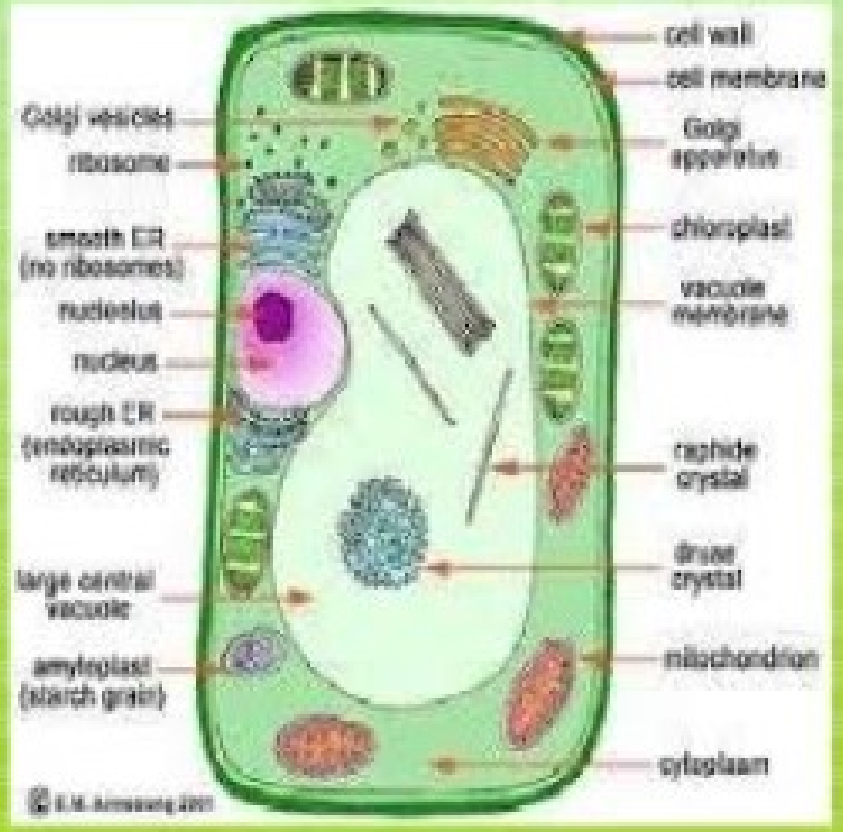
They may remain free in cytoplasmic matrix or attached to cytosolic surface of endoplasmic reticulum.

ORGANELLE

They are found in plastids and mitochondria.

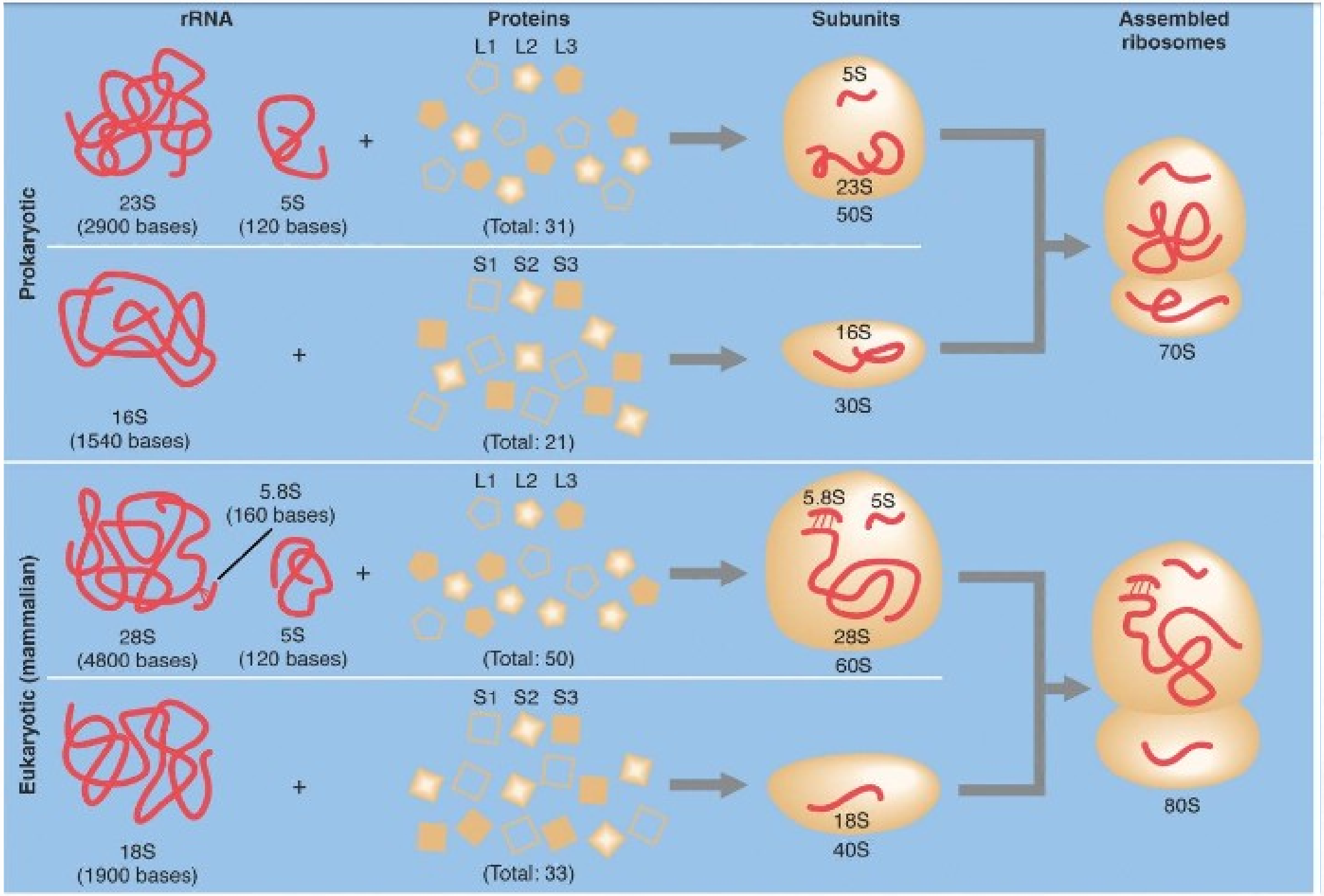
Organelles and Cytoplasm





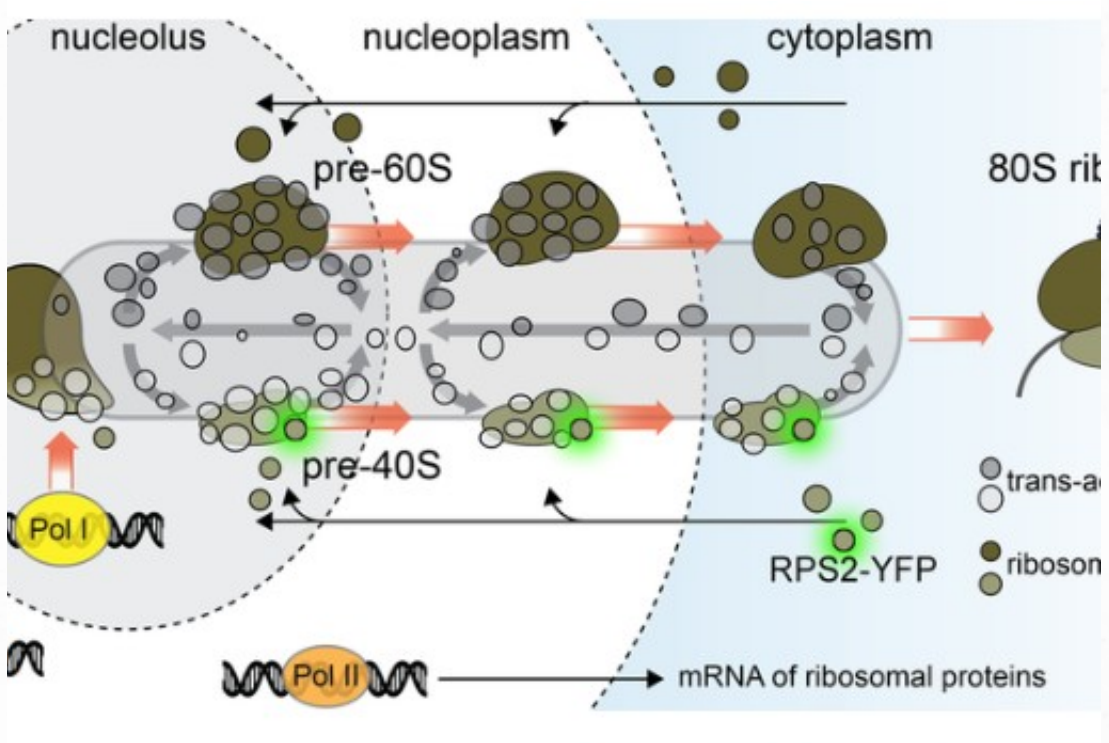
STRUCTURE AND COMPOSITION

- Chemically made up of two parts protein and rRNA.
- The ribosomes of liver cells also contains lipids upto extent of 5 to 10%
- Ribosmol structure is primarily determined by its rNAs.
- RNA occurscin single copies.
- Most of the Protiens are also present in single copies.
- Two copies of same protien are rare.
- Protiens common in both the subunits are also rare.
- All the three RNAs f 70S are formed from a single transcript of 30S.


rRNA
Proteins
Subunits
Assembled ribosomes
Prokaryotic
23S
(2900 bases)
5S
(120 bases)
+
L1 L2 L3
(Total: 31)
5S
23S
50S
16S
(1540 bases)
+
S1 S2 S3
(Total: 21)
16S
30S
70S
Eukaryotic (mammalian)
5.8S
(160 bases)
28S
(4800 bases)
5S
(120 bases)
+
L1 L2 L3
(Total: 50)
5.8S
5S
28S
60S
18S
(1900 bases)
+
S1 S2 S3
(Total: 33)
18S
40S
80S

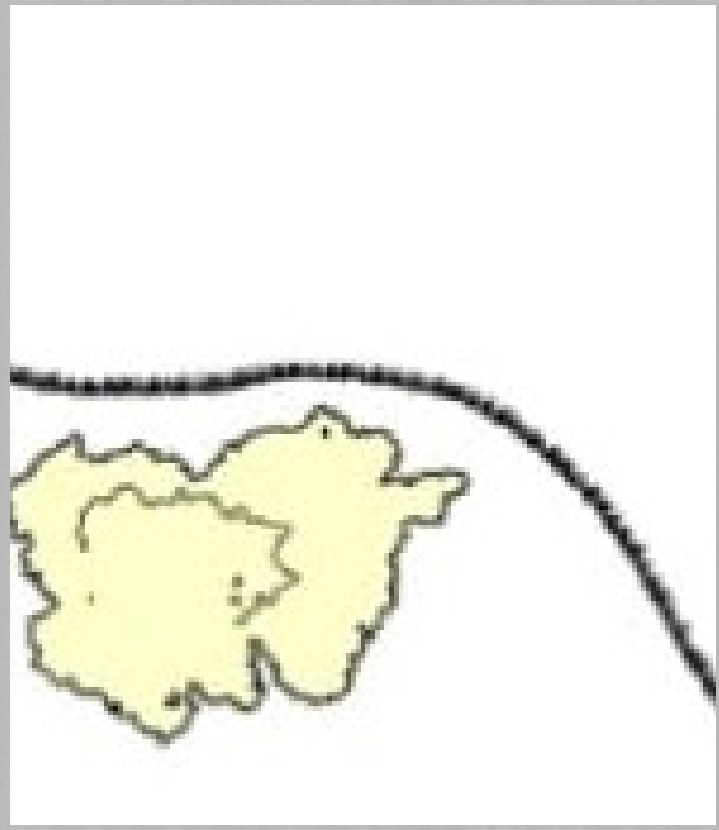
RIBOSOMES BIOSYNTHESIS

In eucaryotes the cytoplasmic ribosomes are synthesised inside the nucleus whereas in procaryote ribosomes synthesis occur in the cytoplasm. Protiens are synthesised over the ribosome in the cytoplasm. They enter the nucleus and passes into nucleolus for getting associated with rRNAs. The two subunits of ribosomes are formed separately. In procaryotes rRNA is synthesised over the nucliod. In cytoplasm RNAs get associated with riboprotiens. to form tge two subunits of ribosomes.



FUNCTIONS

- Protien factories: Ribosomes are site of protien synthesis.
- Enzymes and factors : Ribosomes provide enzymes and factors for condensation of aminoacids and synthesis of polypeptide.
- rRNA: Ribosome contains rRNA which provide attaching point to mRNAs and tRNAs.
- mRNA: Ribosomes have a tunnel for mRNA to ensure that it is translated properly.
- Protection: Newly synthesised polypeptide is protected from cytoplasmic enzymes by enclosing it within a groove of large subunit of ribosome till it attains secondary structure.



DIFFERENCES BETWEEN 70S AND 80S RIBOSOMES

80S RIBOSOMES

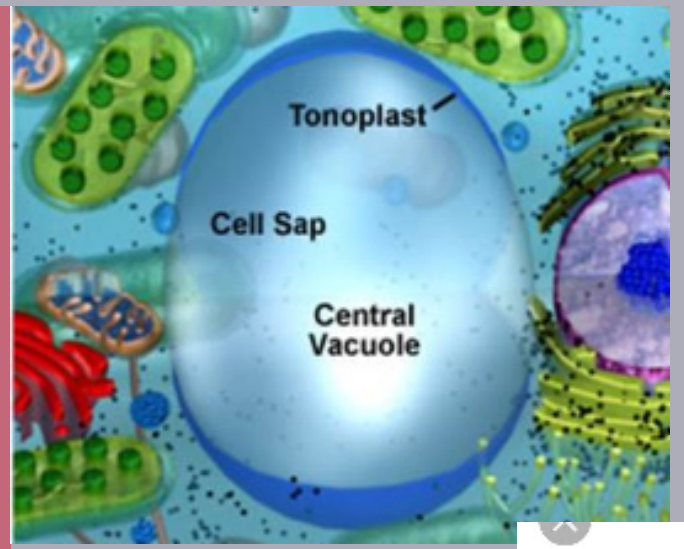
- They occur only in Eukaryotic cells.
- The sedimentation or swedberg coefficient is 80.
- They are comparatively heavier 4.0-4.5 million daltons.
- The two subunits are 40S and 60S.
- The 80S ribosomes are synthesised inside the nucleolus.

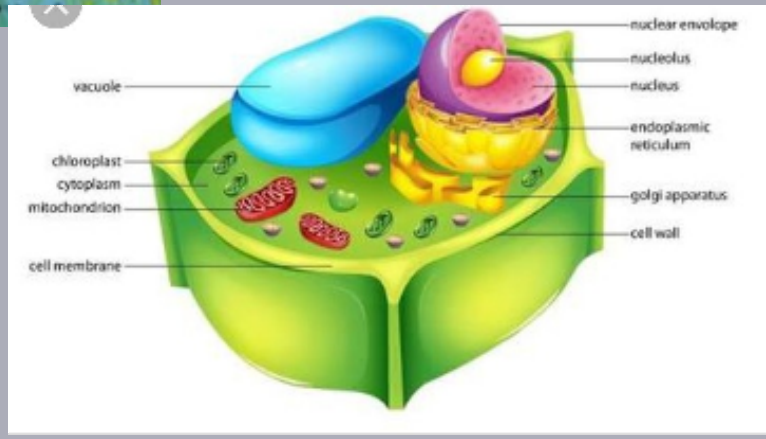
70S RIBOSOMES

- They are found both in Eucaryotes and procaryotes.
- The sedimentation or swedberg coefficient is 70.
- The 70S ribosomes are comparatively lighter, 2.7-3.0 million daltons.
- The two subunits are 30S and 50S.
- The 70S ribosomes are synthesised inside the cytoplasm of procaryotes.

VACUOLES

These are single membrane bound fluid filled bags of different shapes and size. They are fairly developed in plant cells but absent in animal cells except in protozoan.





TYPES OF VACUOLES

Depending upon their content and function these are of 4 types :

1. Sap vacuoles
2. Contractile vacuoles
3. Food vacuoles
4. Air vacuoles

SAP VACUOLES

These are fluid-filled vacuoles bounded by a selectively permeable membrane called tonoplast. These are believed to be developed from trans Golgi complex. As the cell grow bigger this small vacuoles fuse together to form a single large vacuole in plant cell. The fluid present in vacuole is called sap or vacuolar sap.

FUNCTIONS

- Accumulation of solute is one of the major function of plant vacuoles.
- Maintainance of turgor due to accumulation of solutes creates hydrostatic skeleton in plant cells.
- Presence of organelle's fragments shows that it plays the function of antophagy.

CONTRACTILE VACUOLES

These are found in some protistan and algal cells mostly found in fresh water. Contractile vacuoles has highly extensible and collapsible membrane. They absorb extra water from cytoplasm and swells up(diastole). When diastolic membrane comes in contact with plasma membrane they collapse and throws this water out. Collapsing phenomenon is called systole.

Functions:It plays important role in excretion and osmoregulation.

FOOD VACUOLES:

These occur in the cells of protists, lower animals and phaygocytes in higher animals.

The food vacuole is formed with the fusion of phaygosome and lysosome. the the food vacuole contains digestive enzymes which helps to digest nutrients and help them to finally pass to the surrounding cytoplasm.

AIR VACUOLES:

These are also called gas vacuoles or pseudovacuoles. Tgey are found only in prokaryotes. (Bacteria). It consists of small submicroscopic sub viscles. Viscles encloses metabolic gases.

Functions : Air vacuoles not only store gases but provide buoyancy,mechanical strength and protection from harmful radiations.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THANKS
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