

Chapter 5.3 The Cell: Nucleus, Ribosomes

Nucleus

- **Function**
 - ◆ contains eukaryotic cell's genetic library
 - most genes in nucleus
 - some genes located in mitochondria & chloroplasts
- **Size:**
 - ◆ ~ 5 microns (μm) in diameter

Nucleus structure

- **Structure**
 - ◆ separated from cytoplasm by a double membrane, **nuclear envelope**
 - ◆ double membrane is fused in spots forming pores
 - allows large macromolecules & particles to pass through

Nucleus structure

- **Within nucleus, DNA organized into fibrous material, **chromatin****
 - ◆ in normal cell appears as diffuse mass
- **When cell prepares to divide, chromatin fibers coil up as separate structures, **chromosomes****

Nucleus structure

- **Densely stained region in nucleus is nucleolus**
- **Function**
 - ◆ production of ribosomal subunits from rRNA & proteins
 - pass through nuclear pores to cytoplasm & combine to form **ribosomes**

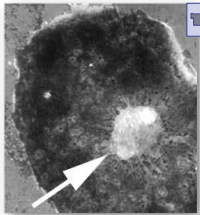
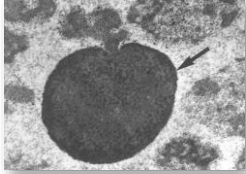
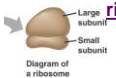
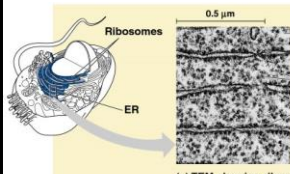
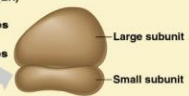




Diagram of a ribosome

Ribosomes

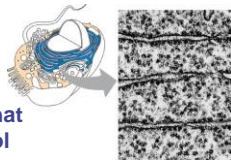
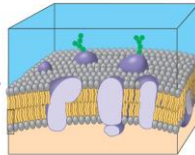
- **Function**
 - ◆ **protein production**
- **Structure**
 - ◆ ribosomes contain **rRNA & protein**
 - ◆ composed of 2 subunits that combine to carry out protein synthesis

(a) TEM showing ribosomes (b) Diagram of a ribosome

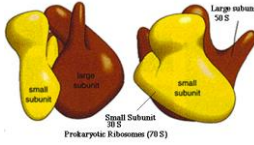
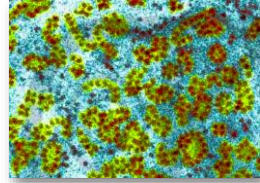
Types of Ribosomes

- **Free ribosomes**
 - ◆ suspended in cytosol
 - ◆ synthesize proteins that function within cytosol
- **Bound ribosomes**
 - ◆ attached to outside of **endoplasmic reticulum**
 - ◆ synthesize proteins for export or for membranes

Ribosomes

- **Prokaryotes & eukaryotes have different ribosomes**
 - ◆ different size subunits
 - ◆ different proteins




Prokaryote vs. eukaryote ribosomes

Component	Prokaryotic	Eukaryotic (mammalian)
rRNA	23S (2900 bases), 16S (1540 bases)	23S (4900 bases), 18S (1900 bases)
sRNA	5S (120 bases)	5.8S (160 bases), 5S (120 bases)
Proteins	L1, L2, L3 (Total: 31); S1, S2, S3 (Total: 21)	L1, L2, L3 (Total: 50); S1, S2, S3 (Total: 33)
Subunits	50S (23S + 16S), 30S (16S)	60S (23S + 5.8S + 5S), 40S (18S)
Assembled ribosome	70S (50S + 30S)	80S (60S + 40S)

Structure of Ribosomes

2000 | 2009

- **Ramakrishnan, Steitz, and Yonath**
 - ◆ determined the structure of the 30S ribosome

Venkatraman Ramakrishnan Thomas Steitz Ada Yonath