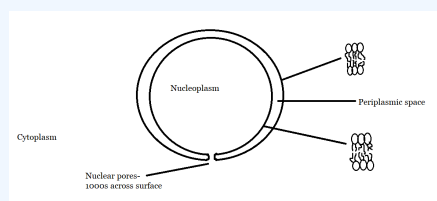


### Cell Theory

|   |                                   |
|---|-----------------------------------|
| Cells are the basic structural & functional unit of life. | Viruses do not qualify as living. |
| All living organisms are composed of cells.               | No cellular structures,           |
| All cells arise from pre-existing cells.                  | don't metabolize,                 |
| Spontaneous generation does NOT occur.                    | not motile,                       |
|   | don't reproduce w/o a host cell   |

### Nucleus



Double phospholipid bilayer membrane (nuclear envelope)  
 Biggest organelle in most cells  
 Ancestral prokaryote membrane folded in on itself, trapping DNA and protecting it

### Nucleus cont.

|   |  |
|---|--|
| The nuclear envelope is very restrictive                                      | Contains most eukaryotic DNA (some DNA in chloroplasts and mitochondria) |
| Organizes DNA with chromosomal territories separated by proteins              | Nucleolus is the site of ribosomal RNA (rRNA) synthesis and assembly     |
| Protein structures and RNA can fit through nuclear pores to leave the nucleus | rRNA is the most abundant form of RNA, and is part of the ribosome       |

### Golgi Apparatus

|   |   |
|---|---|
| Functions to process, sort, and ship molecules synthesized in ER                          | "Post office" of the cell                         |
| Made up of <b>Cisternae</b> - all separate flattened membranes for vesicular transport    |   |
| Cis side- ["same"] side facing ER   | Trans side- ["opposite"] side facing away from ER |
| Vesicular transport can be tracked in a laboratory with a Green Fluorescent Protein (GFP) |   |

### Lysosomes

|   |   |
|---|---|
| ["breaking body"]                                   |   |
| Acidified organelle specializing in digestion       | pH=4.5-5  |
| degrades material via endocytosis                   | (bring into cell, phagocytosis is a type of endocytosis)  |
| enzymes work in the acidified environment to digest | they break down <i>intracellular</i> materials  |
| Aid in <i>Autophagy</i> - ["self-eating"]           | recycle things like mitochondria that are 'expired' to use material for other metabolic functions |

### Cell Diversity

|                              |  |   |
|------------------------------|--|---|
| Measured in micrometers      | $1 \times 10^3 \mu\text{m} = 1\text{mm}$ | $1 \times 10^6 \mu\text{m} = 1\text{m}$ |
| bacteria= 1-10 $\mu\text{m}$ | plant/animal= 10-100 $\mu\text{m}$       |   |
| round, rod, or spiral shape  | shape is linked to function              | <i>Form Fits Function</i>               |

### Cell Diversity (cont)

|   |  |
|---|--|
| Aerobic= needs oxygen   | Anaerobic= without oxygen or oxygen is toxic |
| <b>Prokaryote</b> vs.   | <b>Eukaryote</b>                             |
| >no membrane bound organelles   | >membrane bound organelles                   |
| >Domains Bacteria & Archaea   | >Domain Eukaryota                            |
| >Eukaryotes stress compartmentalization, using organelles with different functions and specialized roles. |  |
| >Protists are included in Eukaryota, being single celled Eukaryotes.                                      |  |

### Ribosomes

|   |  |
|---|--|
| Composed of rRNA and protein - rRNA does the actual translating | Performs protein synthesis (translation)                                       |
| Possessed by <b>ALL</b> cells                                   | Not membrane bound   |
| 2 different populations in eukaryotes:                          |  |
| Free (cytosolic)- floating around, makes cytoplasmic proteins   | Bound to endoplasmic reticulum (ER)- makes ER proteins, cell membrane proteins |
|   | Exists inside chloroplasts and mitochondria (to translate cpDNA and mtDNA)     |

cpDNA= chloroplast DNA  
 mtDNA= mitochondrial DNA

### Smooth ER

site of synthesis of membrane lipids (phospholipids, cholesterol)

Ca<sup>2+</sup> storage for muscle cell contraction

> Ca<sup>2+</sup> is a signalling molecule, kept in the smooth ER until needed for muscle contraction

### Mitochondria

Site of cell respiration (citric acid cycle, e<sup>-</sup> transport)

has endosymbiotic origins:

>double phospholipid bilayer membrane

>ancestral eukaryote with nuclear envelope and ER phagocytized an ancestral prokaryote that was good at cell respiration

**Matrix-** aqueous solution inside mitochondria

**Cristae-** this increases surface area for cell respiration to occur

inner membrane of mitochondria

Key to initiation of **apoptosis-** programmed cell death

occurs when there is DNA damage, metabolic stress, or oxidative stress

### Cytoskeleton

the cell's 'muscles and bones'

**Filamentous proteins-** 'bones', structure, support, shape

**Motor proteins-** 'muscles', contraction, cell movement

Functions:

>contributes to *eukaryotic* cell shape

>controls all aspects of eukaryotic cell motility

### Organelles

| Cell Wall  | Cell Membrane  |
|--|--|
| possessed by most organisms: bacteria, protists, fungi, plants | possessed by <i>every</i> cell   |
| provides structure and shape,                                  | functions as: control entry and exit from cell (semi-permeable),           |
| protection against hypotonic environment,                      | cell communication,  |
| very porous to permit passage of nutrients.                    | adhesion to other cells (anchored with protein complexes).                 |
|  | Phospholipid bilayer moves laterally and fluidly, composed of small pieces |

### Endoplasmic Reticulum



The ER is a physical extension directly connected to the outer membrane of the nuclear envelope.

> proteins in the nuclear membrane can diffused directly into the ER

**Lumen**= space in between membrane of ER

### Rough ER

"Rough" because of ribosomes on the surface

site of synthesis for:

|   |   |
|---|---|
| endomembrane system proteins                            | secreted proteins   |
| Endomembrane system: ER, golgi, lysosome, cell membrane | Secreted proteins function outside cells (eg. antibodies) |

### Rough ER (cont)

>nucleus/rough/smooth ER -> vesicle -> golgi -> vesicle -> lysosome or cell membrane

### Chloroplast

Site of photosynthesis (CO<sub>2</sub> to glucose etc. using light energy)

(plants, photosynthetic protists)

**Thylakoid-** flat stacks of membrane, possess photosynthetic enzymes

>site of *light reaction*

**Stroma-** aqueous solution within chloroplast

>site of *dark reaction/- Calvin cycle*

Double phospholipid bilayer membrane

endosymbiotic origins: photosynthetic prokaryote became organelle in eukaryote

### Evidence of Endosymbiosis

Mitochondria and Chloroplasts possess:

>double phospholipid bilayer membrane

|                            |                          |
|----------------------------|--------------------------|
| >mtDNA (mitochondrial DNA) | >cpDNA (chloroplast DNA) |
|----------------------------|--------------------------|

>ribosomes

>division that mimics that of bacteria (*binary fission*)

>division is completed when 'half-life' of mitochondria/chloroplast is spent