Organelles

AP Biology Chapter 6

Organelle Presentations

Eukaryotic cells have internal membranes that compartmentalize their functions

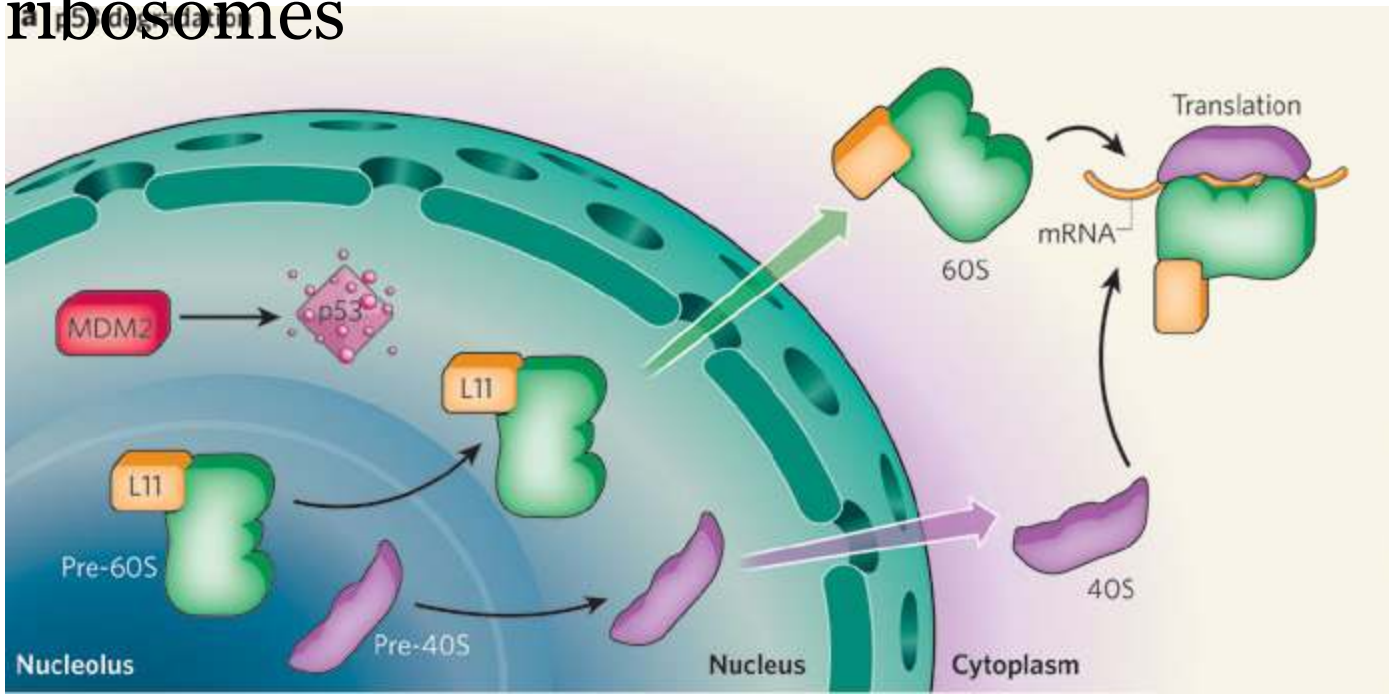
Membranes make organelles

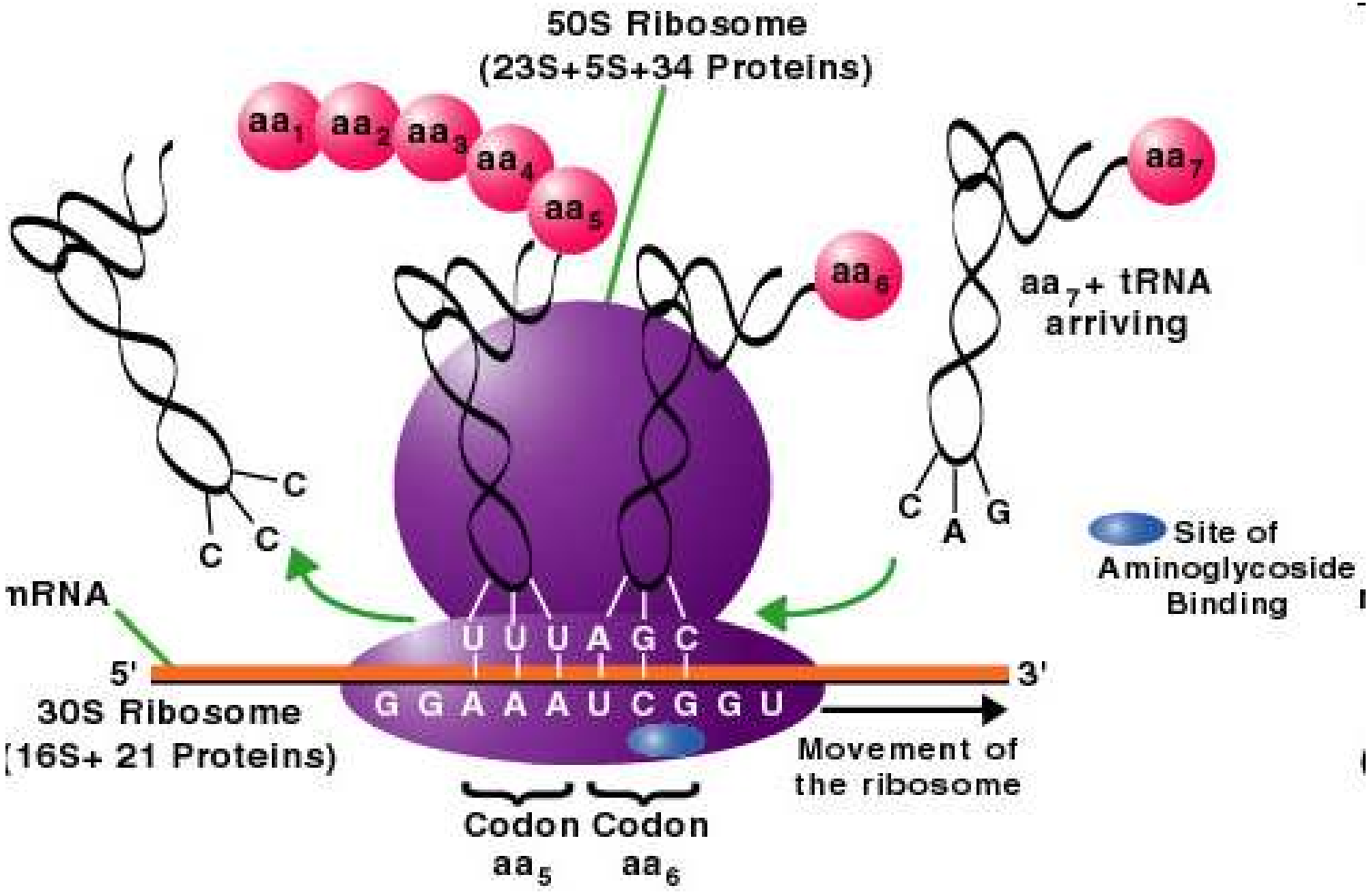
- Organelles are created by membrane partitioning
- Why might this be a benefit to cells?
  - Processes operate more efficiently
    - Decreases conflicting reactions
  - Increased surface area for reactions
  - Reactions related to production of a product are localized

- Organelles are compartments
  - Set apart for specific types of reactions

Ribosomes: Protein factories in the cell

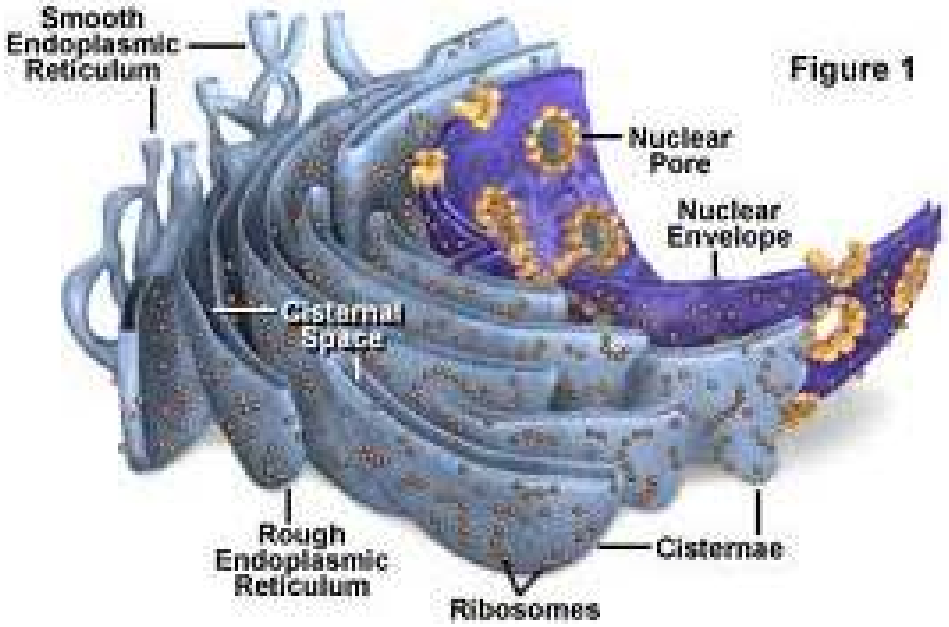
- Made of protein and rRNA
- The site of protein synthesis
- Cells that make more proteins have more ribosomes




50S Ribosome
(23S+5S+34 Proteins)
aa1 aa2 aa3 aa4 aa5
aa6
aa7
aa7+ tRNA
arriving
C
C
C
C A G
Site of
Aminoglycoside
Binding
mRNA
5'
3'
U U U A G C
G G A A A U C G G U
30S Ribosome
(16S+ 21 Proteins)
Movement of
the ribosome
Codon Codon
aa5 aa6

Ribosomes: Protein factories in the Cell

- Ribosomes can be found in 2 types of places
  - Free floating in the cytoplasm
  - Bound to nuclear envelope or endoplasmic reticulum
- Why might two locations be helpful?



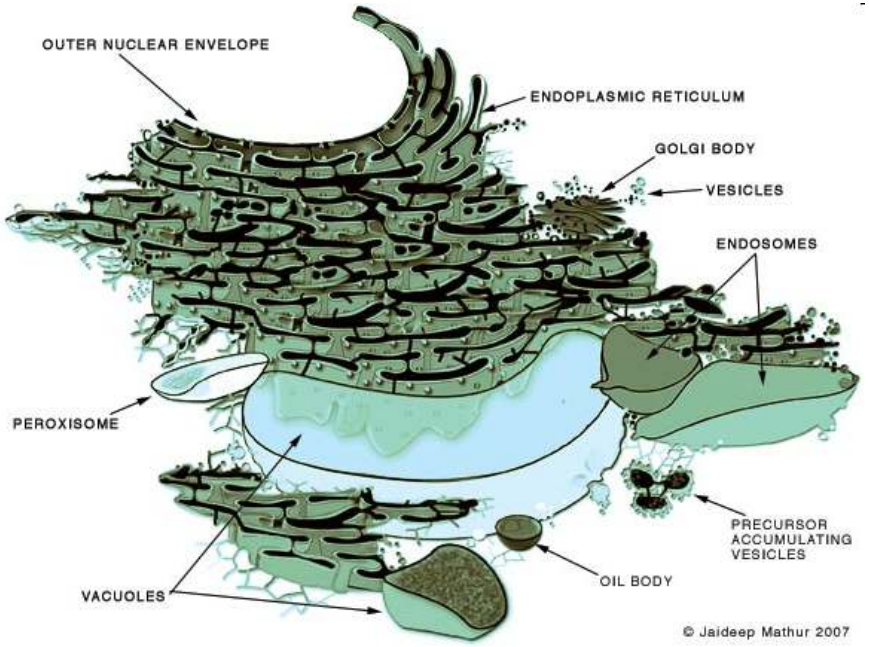
The Endomembrane system

Regulation of protein traffic and performance of metabolic functions in the cell

The Endomembrane system

- System of organelles that are related due to sharing of membranes as vesicles or their physical connection

- Includes:
  - Nuclear envelope
  - Endoplasmic reticulum
  - Golgi apparatus
  - Lysosomes
  - Other vacuoles
  - plasma membrane *

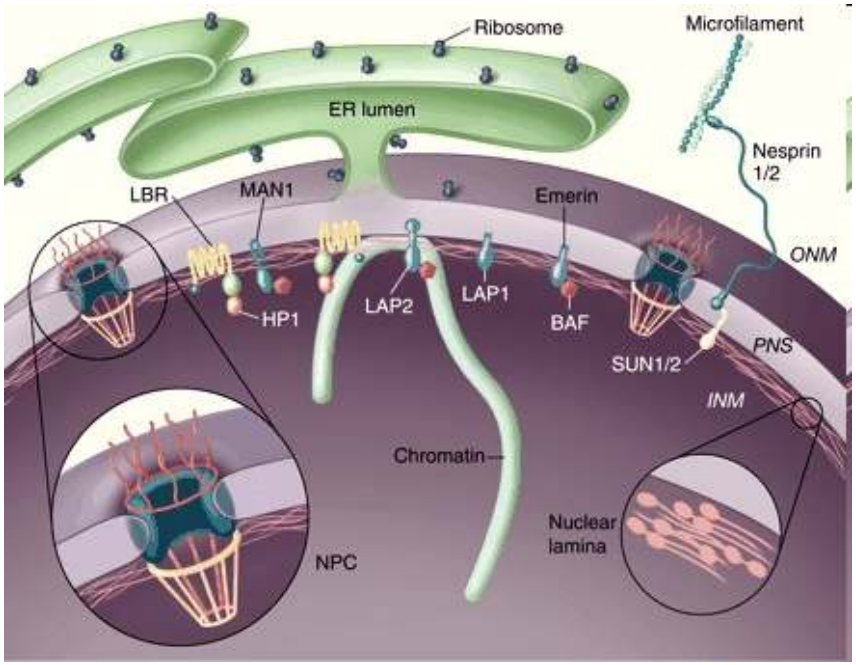


The Endoplasmic Reticulum: Biosynthetic Factory

- Endo- within
- Plasmic – cytoplasm
- Reticulum- little net

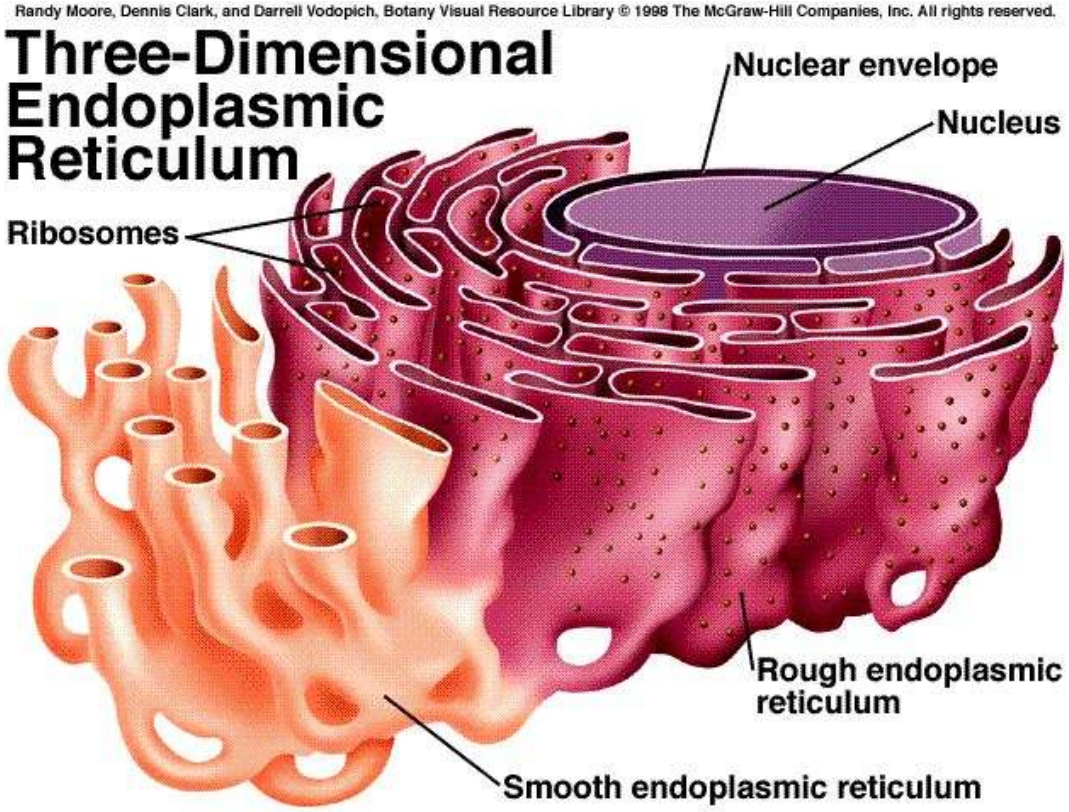
- Made of cisternae (liquid reservoir) tubes and sacs
- Inner part called the lumen (cavity)

- Continuous with the nuclear envelope



The Endoplasmic Reticulum: Biosynthetic Factory

- Divided into Smooth and Rough ER
- Continuous with the nuclear membrane



Smooth ER

- Synthesis of lipids
  - Oils, steroids, phospholipids
- Metabolism of carbs
- Detoxification
  - Helps by adding hydroxyl group
  - Toxins induce ER proliferation
  - **Liver Cells**
- Storage of calcium ions
  - Pumped from cytosol to lumen
  - **Muscle cells**

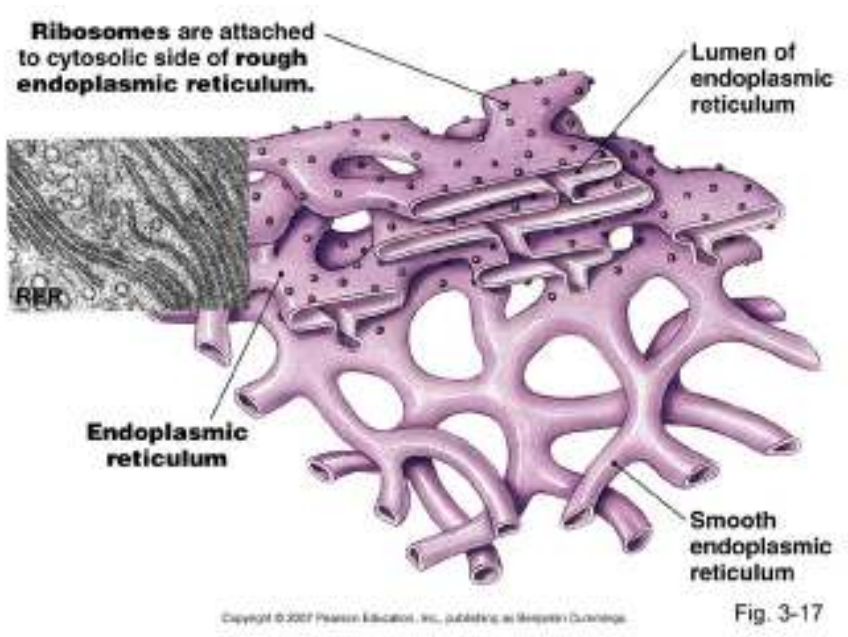
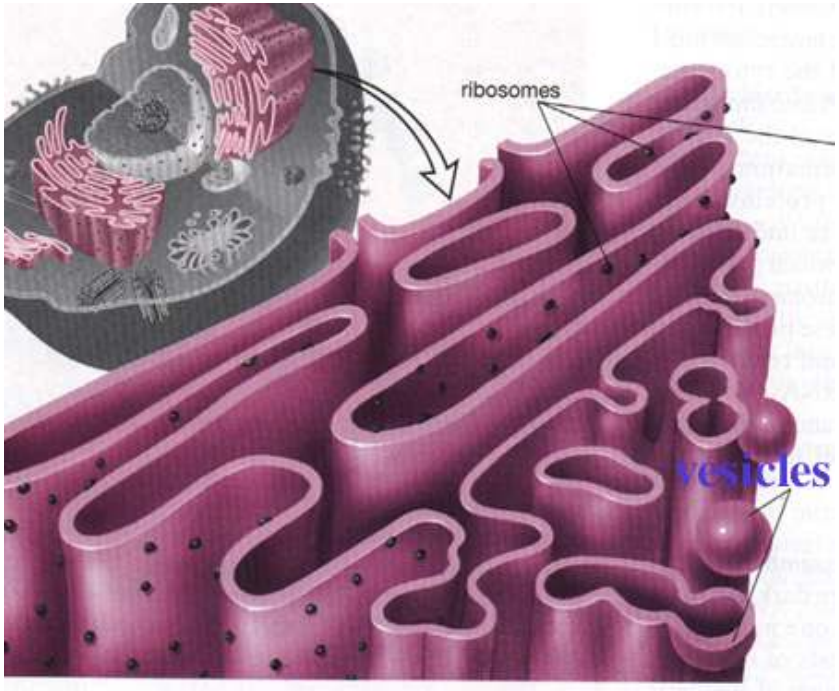


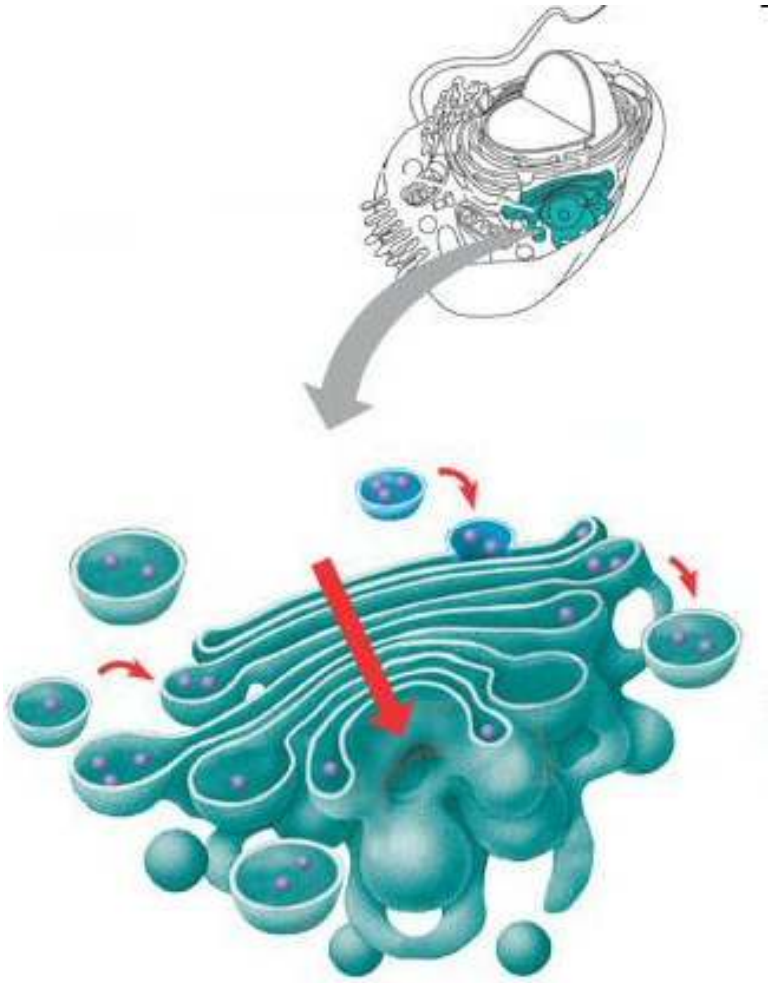
Fig. 3-17

Rough ER



- Secretes proteins created by bound ribosomes
- Helps proper protein conformation (ex: insulin)
- Most are glycoproteins
- Secreted in transport vesicles from the transitional ER
- Produces additional membrane by making proteins and phospholipids

Golgi Apparatus: Shipping and receiving Center



- Vesicles from ER travel to Golgi
- Membranes fuse
- Manufacture, modify, warehouse, sorting, shipping.
- Larger in cells specialized for secretion
- Manufactures polysaccharides
- Adds molecular ID tags that aid in sorting (zip code).
- Membranes recognize docking sites on membranes or other organelles

The Golgi Apparatus

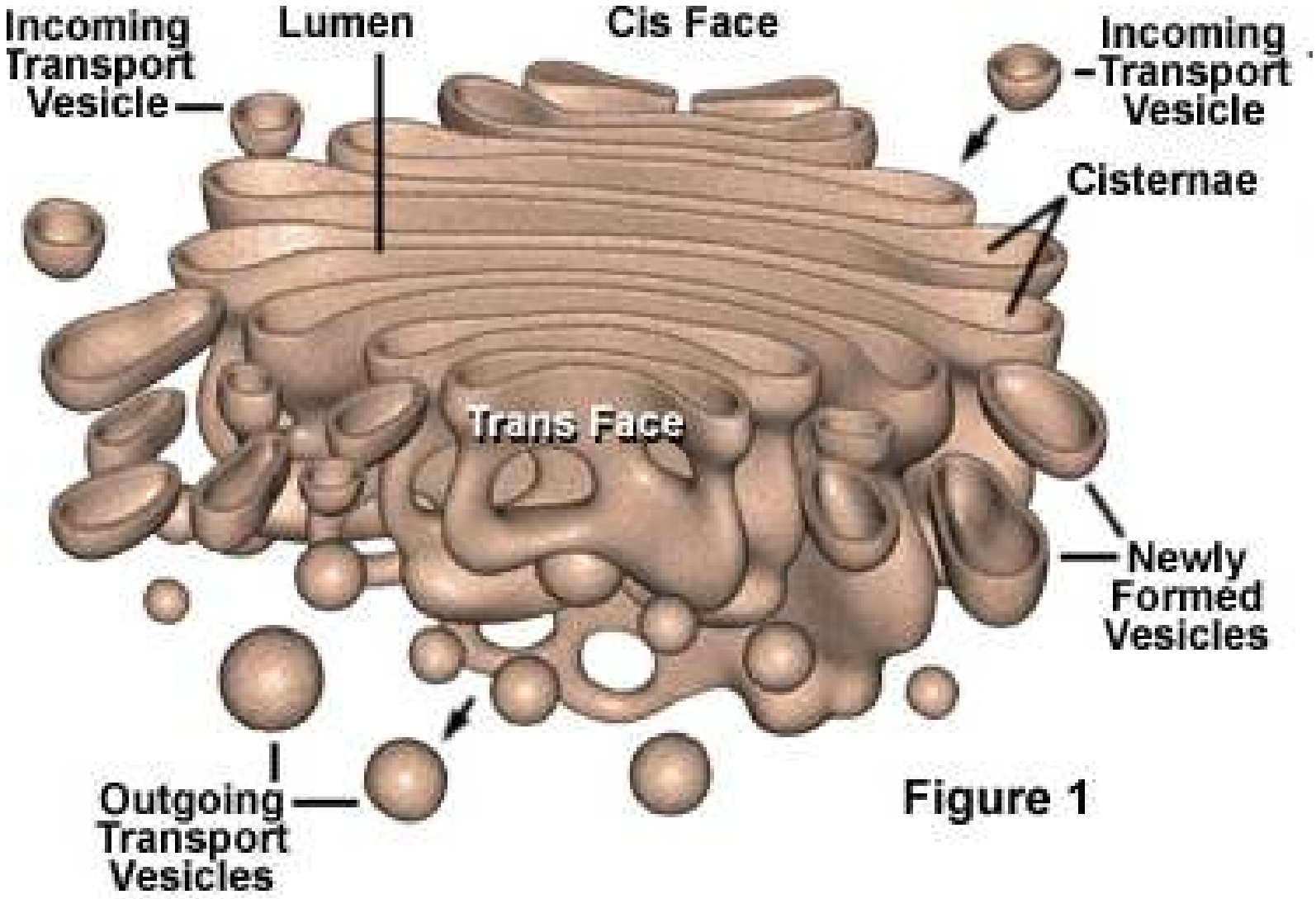
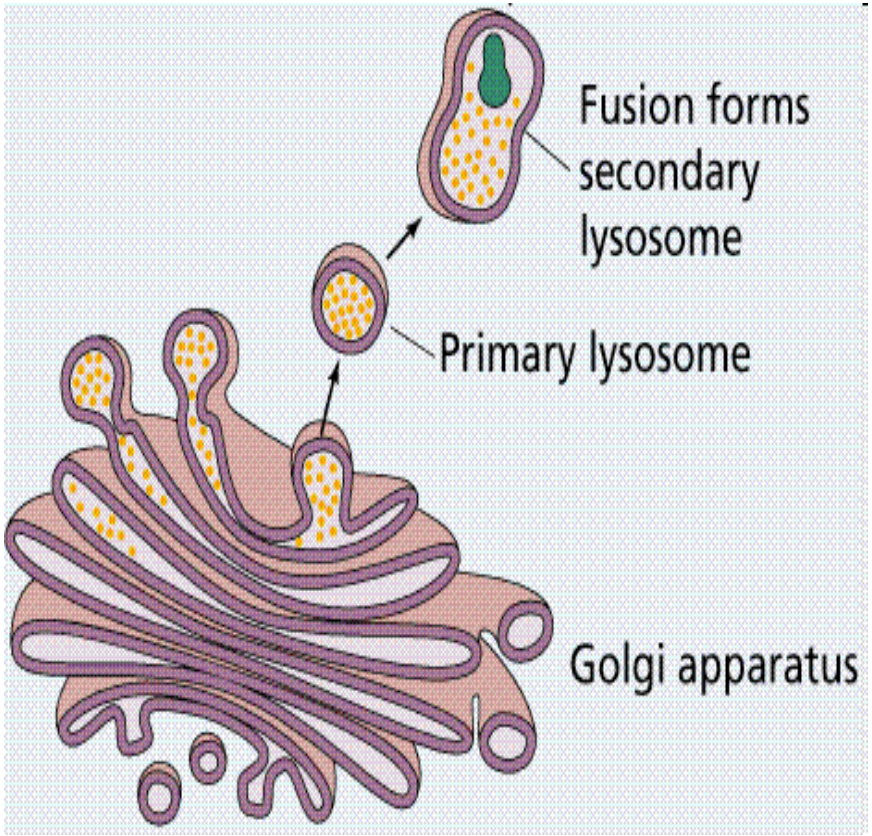


Figure 1

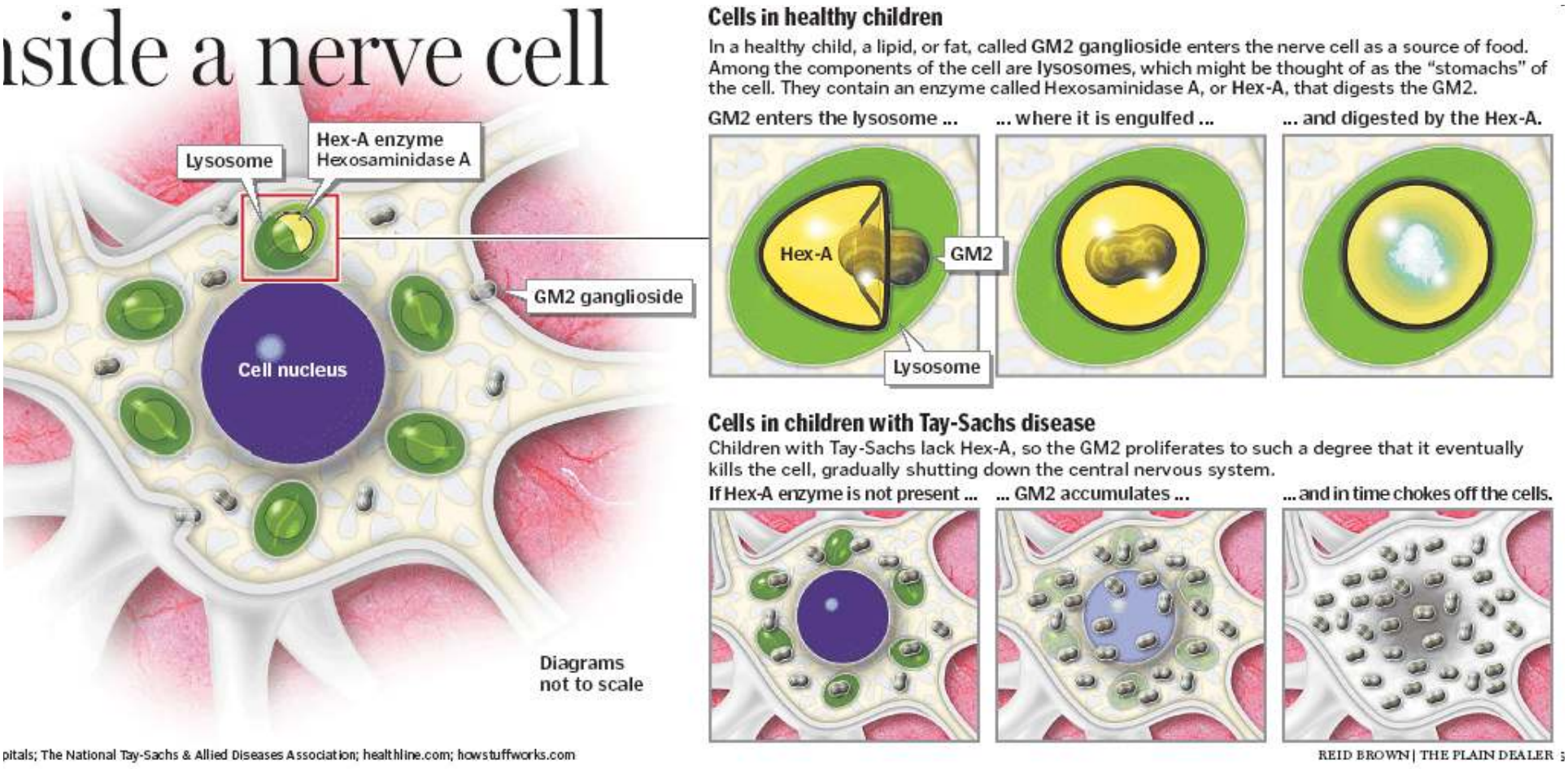
- Cis-face accepts and trans-face secretes.
- What happens in the cisternal maturation model?

Lysosomes: Digestive Compartments



- Found only in animal cells
- Vesicle of hydrolytic enzymes
- Produced by the ER and processed by the Golgi
- Carry out intracellular digestion
- Recycle cellular material back into the cytosol

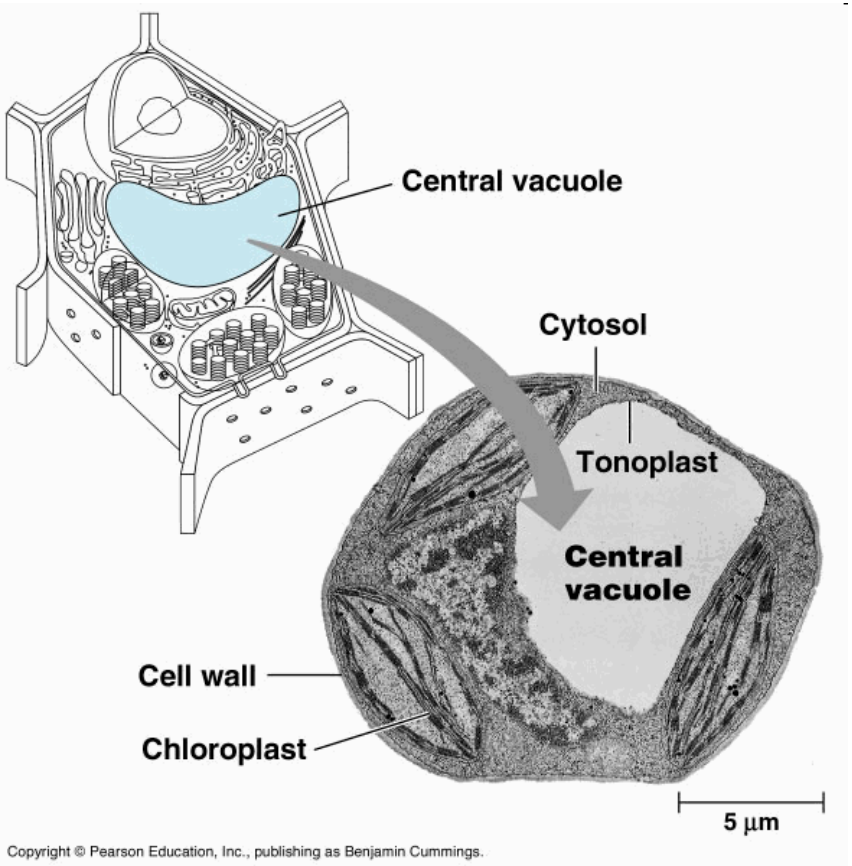
Tay-Sachs (missing lipid enzyme)



pitals; The National Tay-Sachs & Allied Diseases Association; healthline.com; howstuffworks.com

REID BROWN | THE PLAIN DEALER

Vacuoles: Diverse Maintenance Compartments



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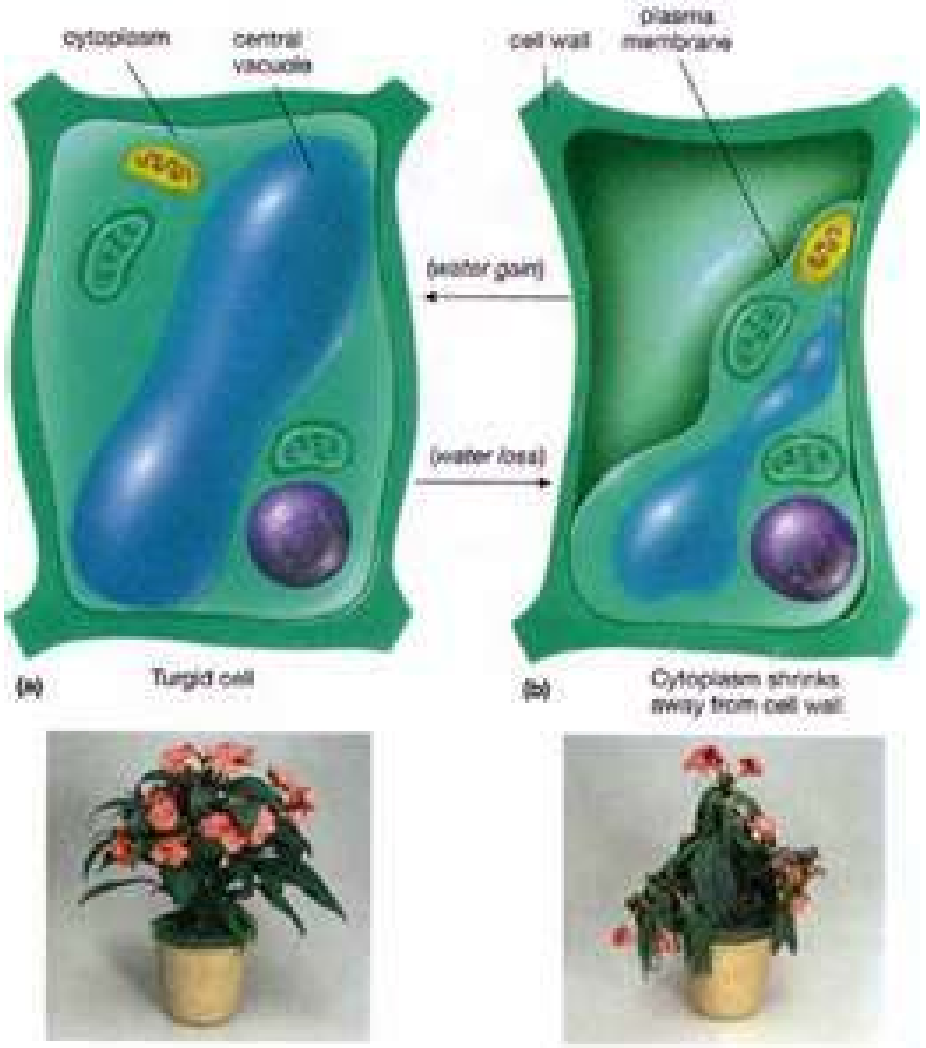
- Commonly found in plants and fungi
- Many functions
  - Hydrolysis (similar to lysosome)
  - Storage of food and water, waste/toxins, pigments and defense chemicals
  - Food Vacuoles
  - Contractile Vacuole
  - Central Vacuole

Central Vacuole

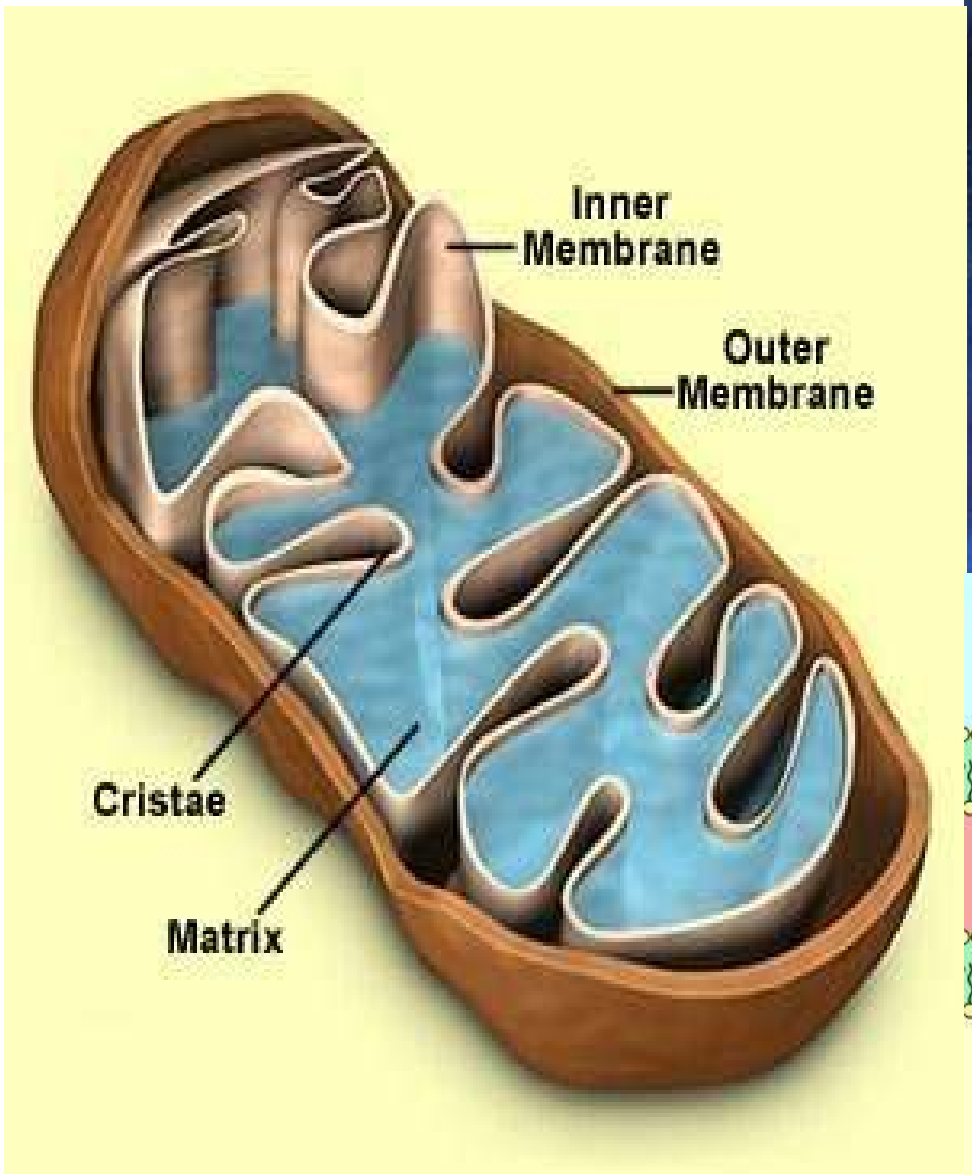
- Central Vacuole: storage of organic molecules and inorganic ions
- Disposal site for wastes and toxins
- Pigments
- Defense chemical s
- Major role in growth – vacuole enlarges as water absorbed

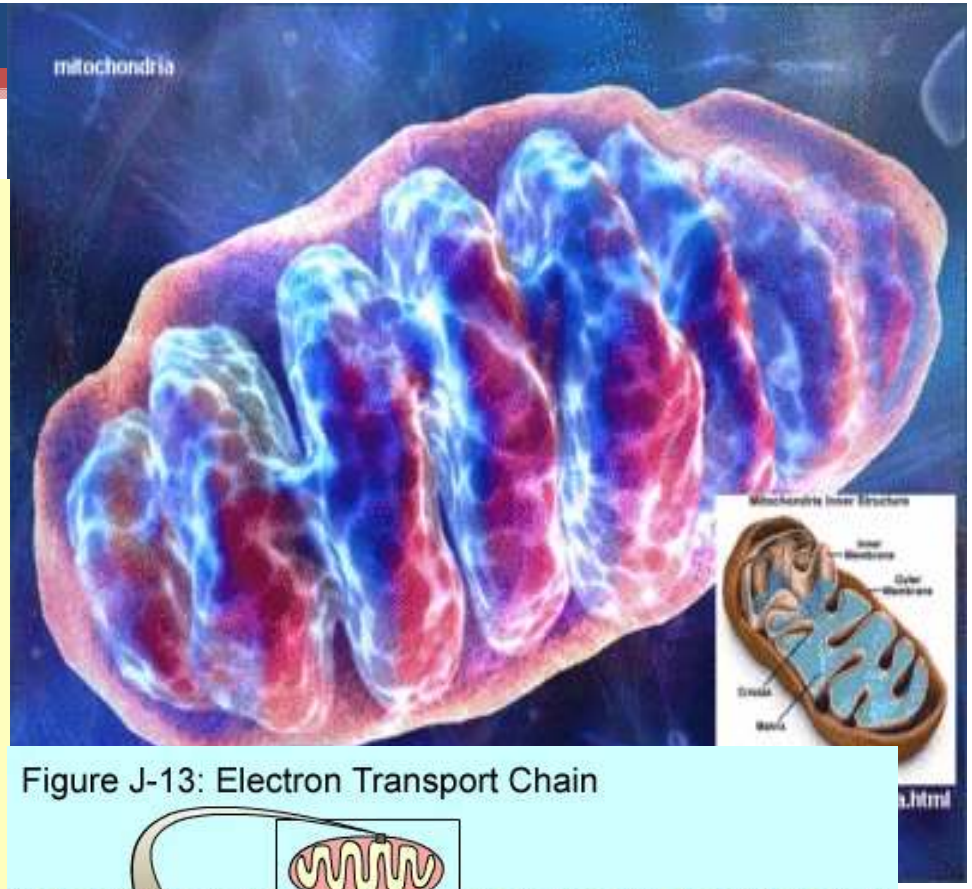


Mitochondria and Chloroplasts change energy from one form to another

Mitochondria: Chemical Energy Conversion

- Site of Cellular Respiration which generates ATP
- Found in most Eukaryotes
- Numbers vary
- Double Membrane with proteins
  - Cristae (Surface area)
  - Matrix
- Contains own DNA, enzymes, and ribosomes
- Semiautonomous m reproduction


Inner Membrane
Outer Membrane
Cristae
Matrix


mitochondria

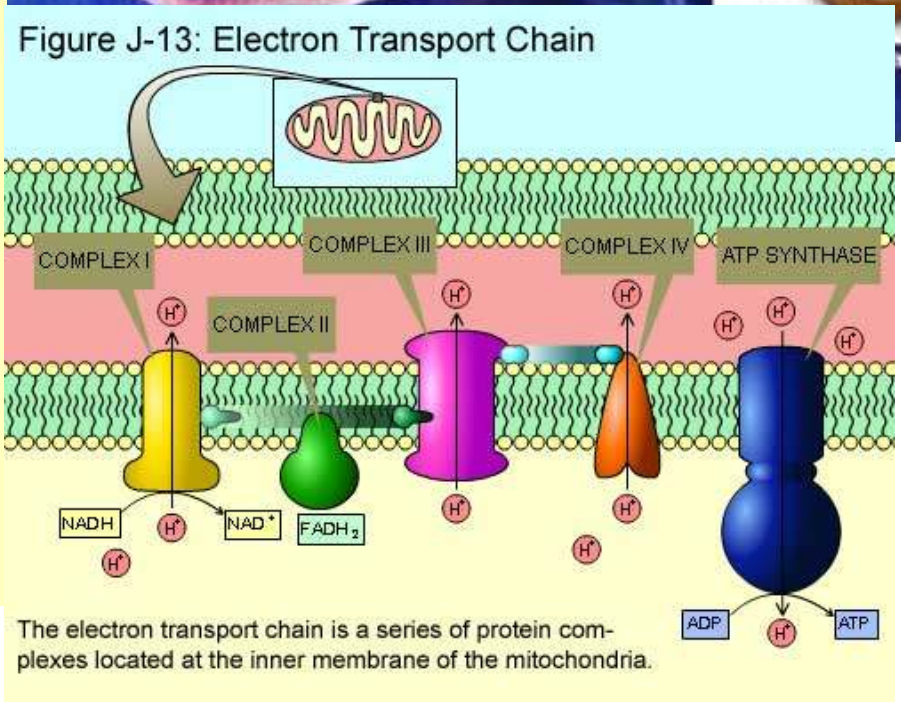
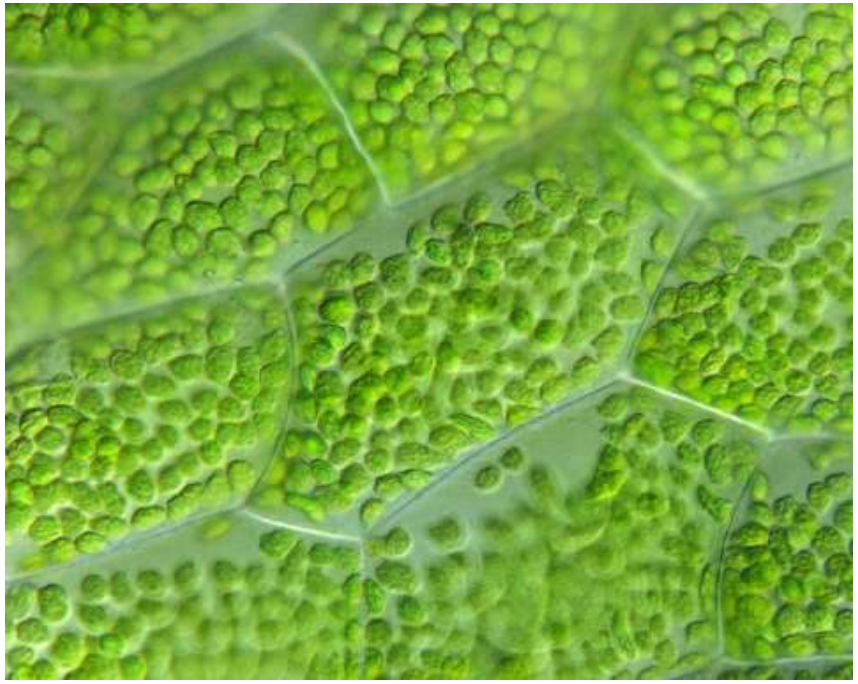


Figure J-13: Electron Transport Chain
COMPLEX I
COMPLEX II
COMPLEX III
COMPLEX IV
ATP SYNTHASE
NADH
NAD+
FADH2
ADP
ATP
The electron transport chain is a series of protein complexes located at the inner membrane of the mitochondria.

Chloroplasts: Capturer of Light Energy

- A compartment for …?
  - Photosynthesis!
- Double membrane case with thylakoid membranes
  - Site of reactions
  - Stroma and Grana
- Found only in plants and algae
- Contains chlorophyll, enzymes, ribosomes, and DNA.
- Semiautonomous reproduction
- A member of the plastid family



Plant Cell Chloroplast Structure

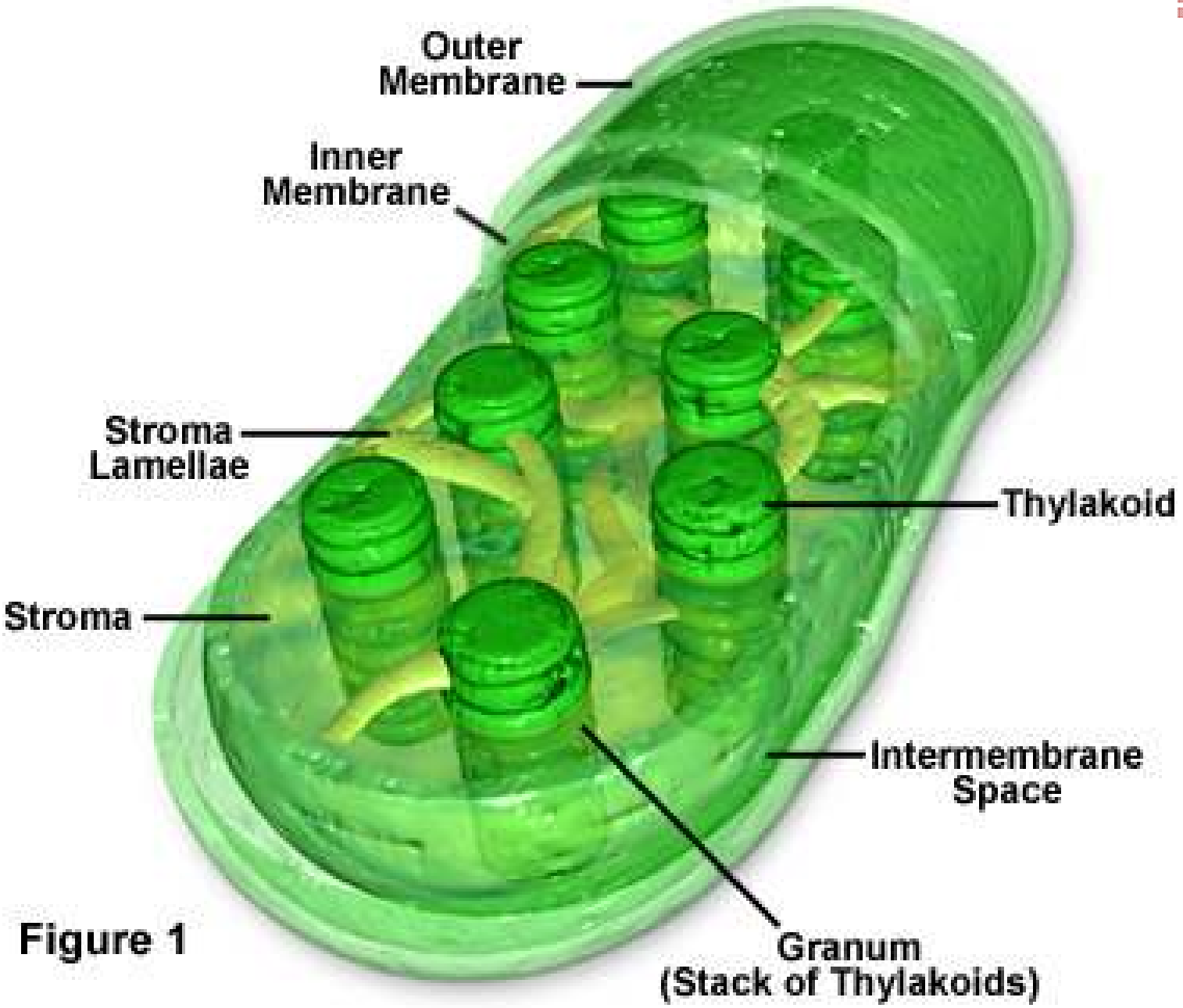
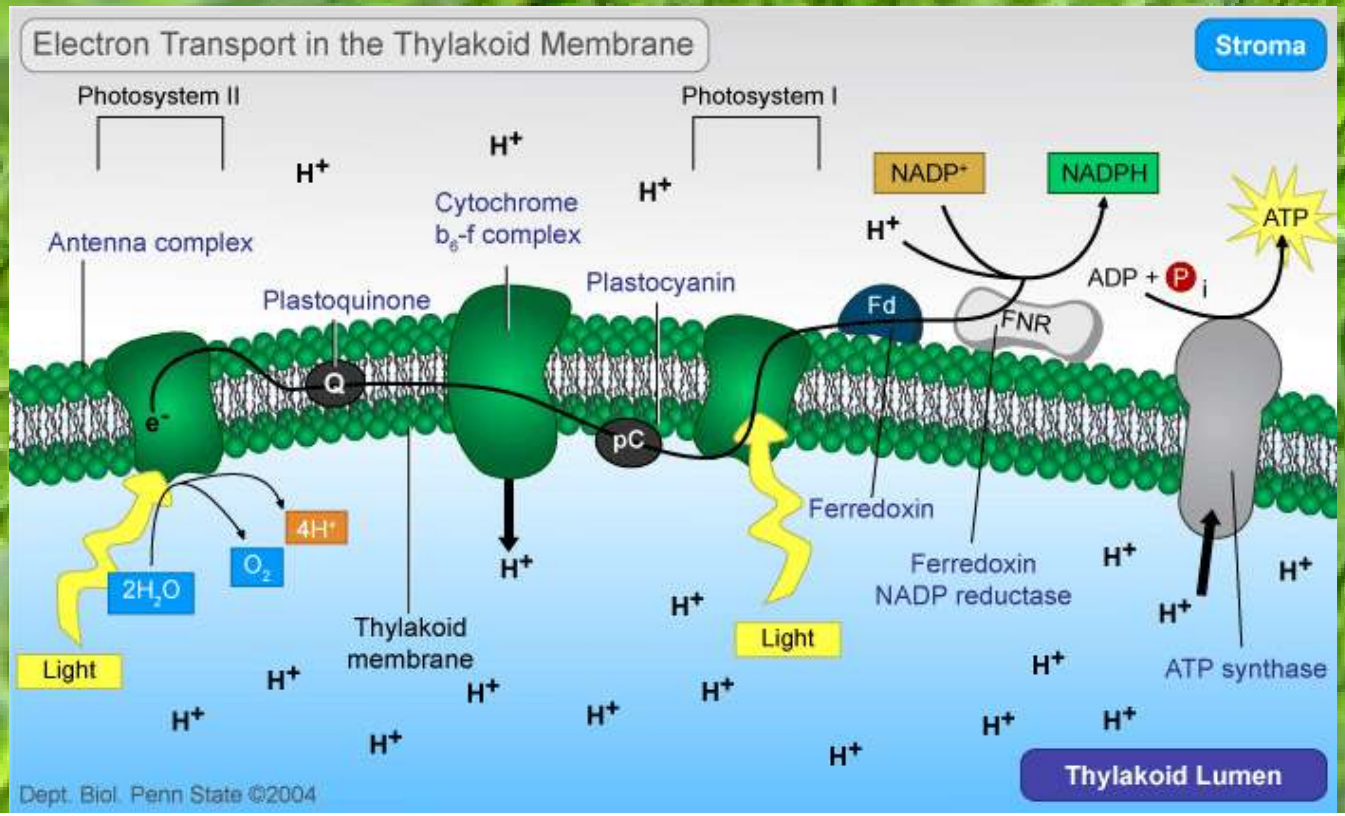


Figure 1


Electron Transport in the Thylakoid Membrane
Stroma
Photosystem II
Photosystem I
Antenna complex
Cytochrome
b_6-f complex
Plastoquinone
Plastocyanin
Fd
FNR
NADP+
NADPH
ATP
ADP + P_i
Q
pC
e-
$2H_2O$
O_2
4H+
Light
Light
Thylakoid
membrane
Ferredoxin
Ferredoxin
NADP reductase
ATP synthase
H+
Thylakoid Lumen
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Peroxisomes: Oxidators

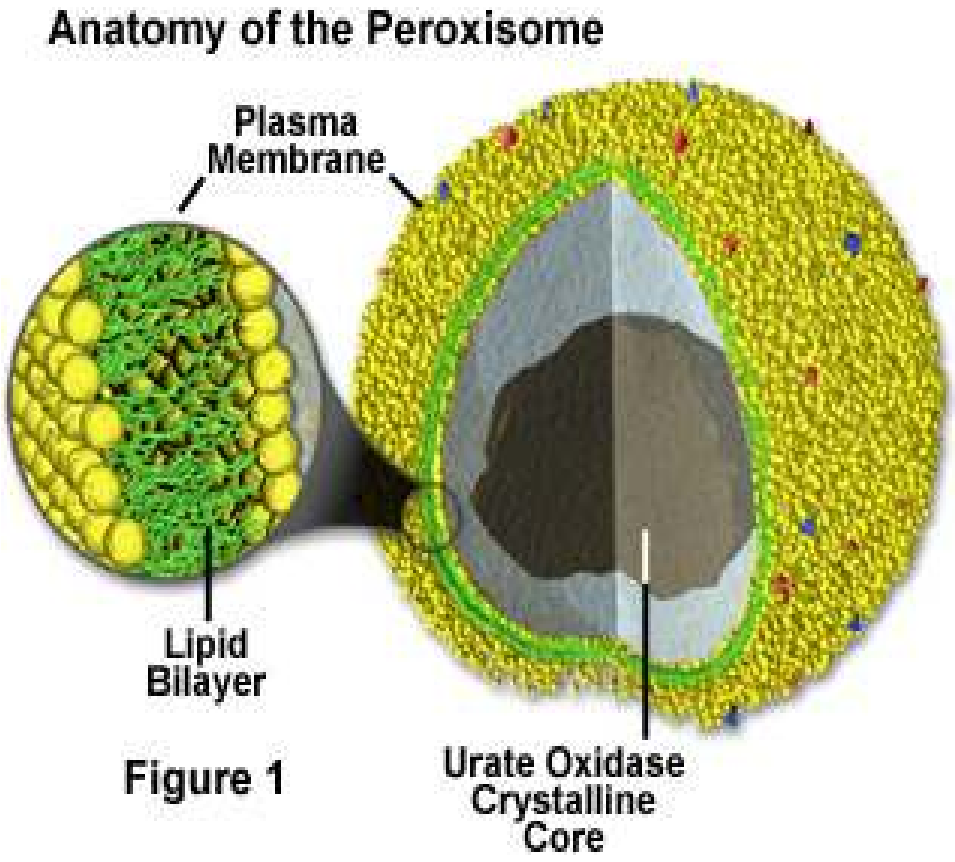

Figure 1

- Single membrane
- Help with metabolism.
- Transfers hydrogens to oxygen producing hydrogen peroxide as a byproduct
- $H_2O_2 \rightarrow H_2O$ later
- Detox in liver cells.
- Prepare fats as fuel for mitochondria.
- Can split in 2 when too large