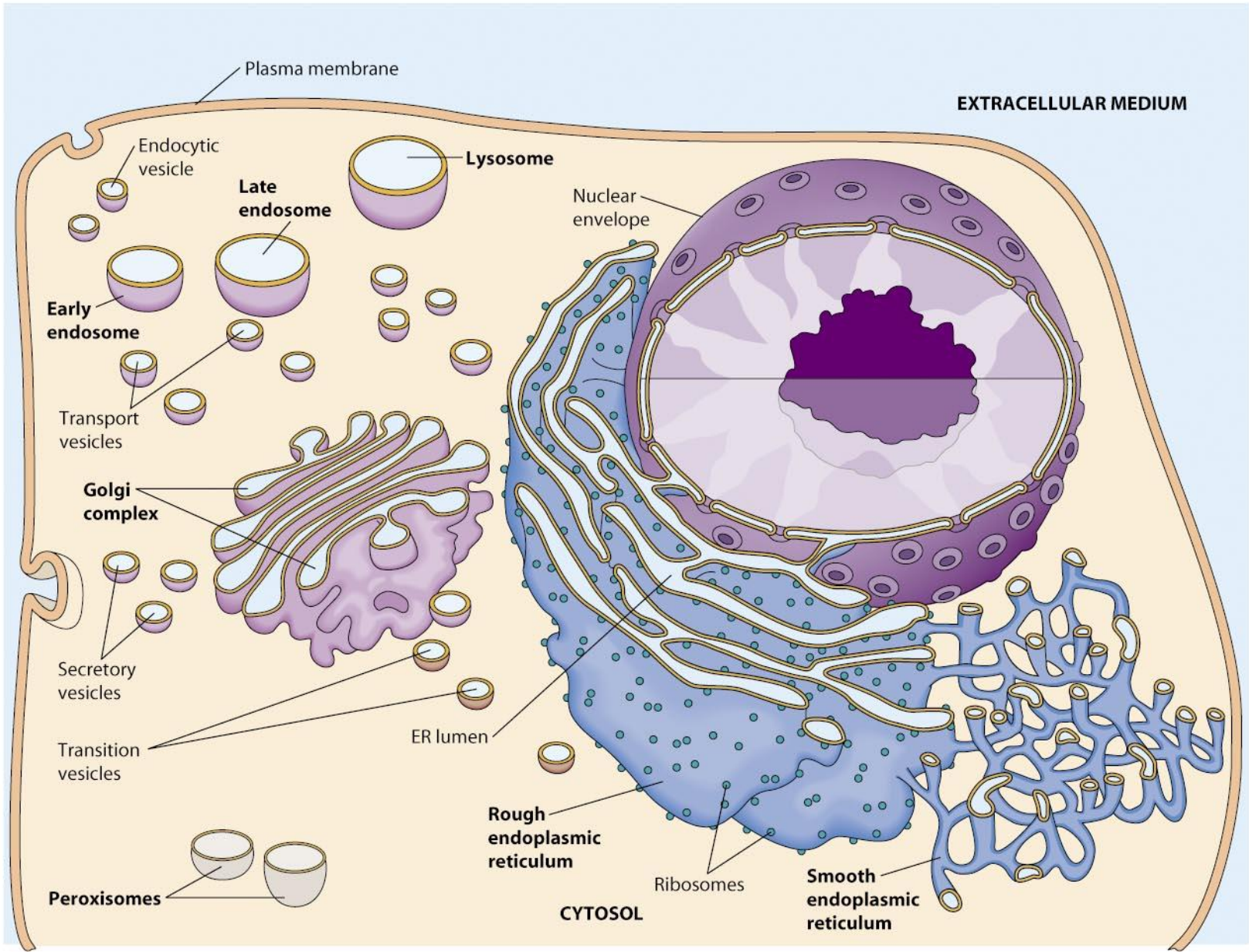


Endoplasmic Reticulum

Endoplasmic Reticulum

- Endoplasmic- within the cytoplasm
- Reticulum – network
- Function
 - Biosynthesis of proteins destined for incorporation into plasma membrane
 - Synthesis of proteins destined for export from cell
 - Biosynthesis of lipids a) cholesterol b) plasma membrane
 - Incorporation into organelles of endomembrane system



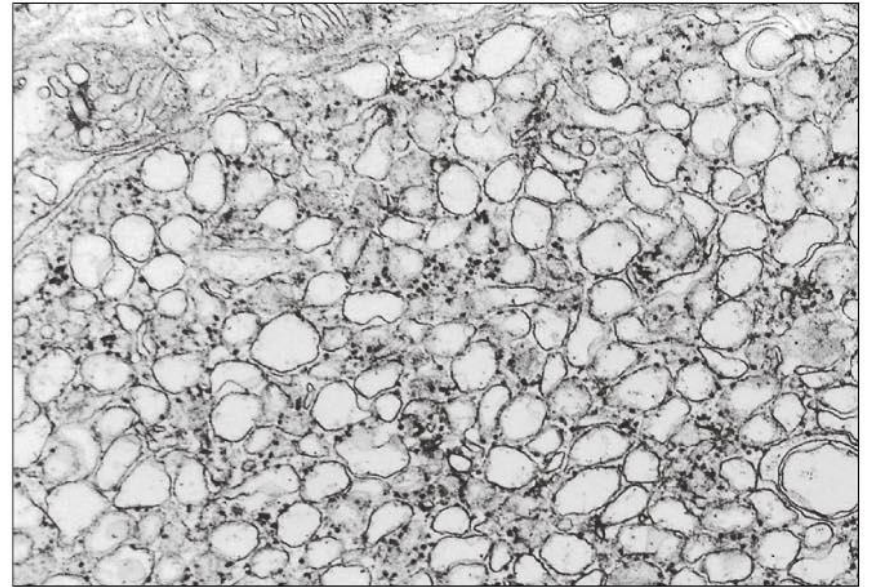
Smooth Endoplasmic Reticulum

- Without Ribosomes
- Found often in ovary and testes
- Continuous with rough endoplasmic reticulum
- Tubular in shape



(a) Rough endoplasmic reticulum

0.5 μm



(b) Smooth endoplasmic reticulum

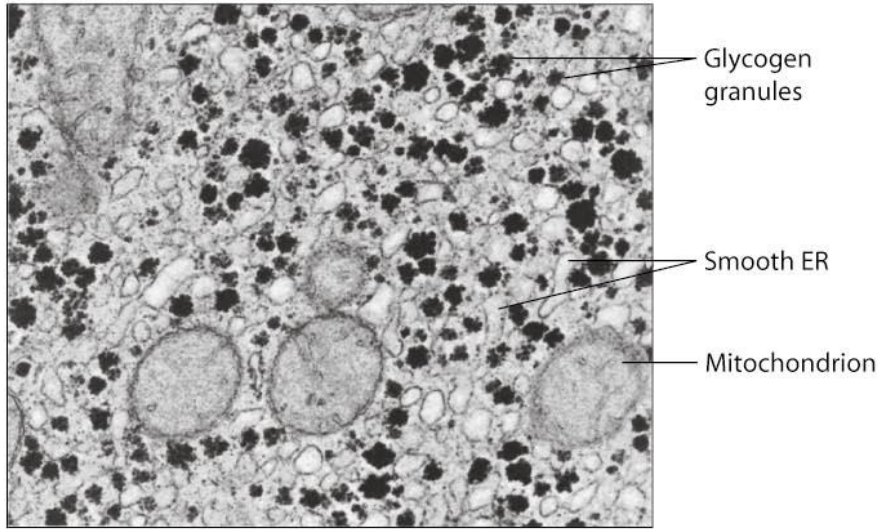
0.5 μm

Smooth Endoplasmic Reticulum

- Drug Detoxification involves hydroxylation
- Addition of OH groups are more soluble and easier to excrete
- If not soluble, hydrophobic toxins may stay in membrane of cells
- Reduced form of Cytochrome P-450 hydroxylates organic hydroxyl acceptor
- Class of enzymes called mixed-function oxidases

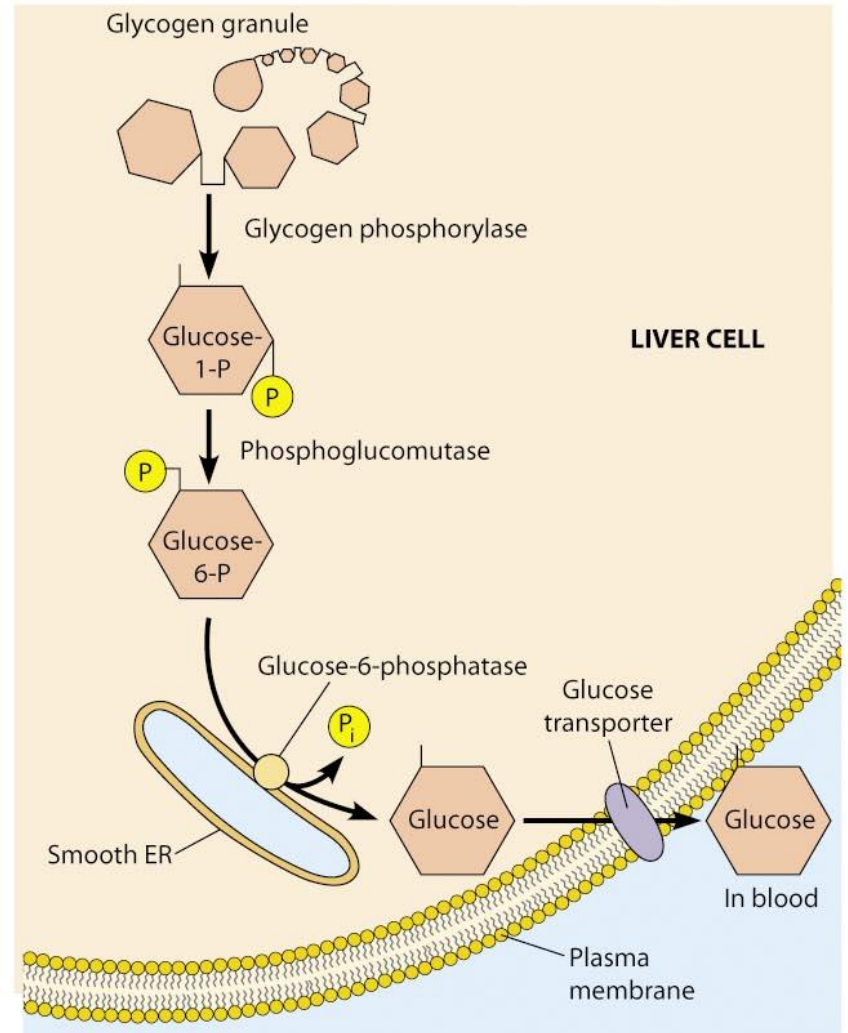
Smooth Endoplasmic Reticulum

- Carbohydrate Metabolism
 - Membrane of smooth ER of hepatocytes contain glucose-6-phosphase (breaks down glucose-6-phosphate into glucose)
 - Glycogen is stored in liver
 - Allows glucose to leave cell and travel into blood system



(a) Proximity of glycogen to smooth ER

0.5 μm



(b) Process of glycogen breakdown in liver

Smooth Endoplasmic Reticulum

- Calcium Storage
 - Sarcoplasmic Reticulum in muscle cells is an example of smooth ER that specializes in storage of calcium
 - Lumen has ATP dependent calcium ATPases which aids in muscle contraction

Smooth Endoplasmic Reticulum

- Steroid Biosynthesis
 - Cholesterol, cortisol, testosterone, estrogen
 - All share a 4-ring structure but differ by hydroxyl groups & carbons side chains
 - P-450 monooxygenases are important in steroid hormones by hydroxylation

Rough Endoplasmic Reticulum

- Transitional Elements (TE) – plays role in formation of vesicles
- Transition Vesicles – shuttle lipids and/or proteins
- Flattened sacs
 - Proteins enter lumen cotranslationally
 - Proteins are anchored by hydrophobic interactions or covalent attachments
 - Soluble proteins are released into lumen

Rough Endoplasmic Reticulum

- Phospholipid translocators (flippases) move phospholipids from ER to their destination by fusing of membrane
- In cases of no fusion, phospholipid exchange proteins recognize specific phospholipids and move them to destination (mitochondria, chloroplast, peroxisome)

Rough Endoplasmic Reticulum

- Responsible for addition of carbohydrates to proteins
- Folding of proteins
- Recognition and removal of misfolded proteins
- Assembly of multimeric proteins
- Contains enzymes for posttranslational and cotranslational modification such as disulfide bonds
- Quality control – ER associated degradation proteins ERAD (cytoplasmic proteases)

Rough Endoplasmic Reticulum

- Protein Glycosylation
 - N-linked glycosylation – oligosaccharide unit to attach to nitrogen on asparagine
 - O-linked glycosylation – oligosaccharide unit to attach to oxygen on hydroxyl group of serine or threonine

Rough Endoplasmic Reticulum

- Formation of Core Oligosaccharide occurs in the Cytoplasm
 - Dolichol Phosphate inserted into ER membrane
 - 2 *N*-acetylglucosime (GlcNAc) are added to dolichol
 - Addition of 5 mannose sugars

Rough Endoplasmic Reticulum

- N-Glycosylation
- Formation of Core Oligosaccharide
 - 2 GlcNAc units
 - 9 Mannose
 - 3 Glucose