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Endoplasmic Reticulum

Study Guide — Cell Organelles

Pre-Med practice questions about rough and smooth endoplasmic reticulum

7 items — Study Guide with Answers

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1 **A newly synthesized plasma membrane receptor first appears in the lumen or membrane of which organelle?**

A Nucleus.

B Mitochondrion.

C **Rough endoplasmic reticulum.** ✓

D Golgi apparatus.

E Lysosome.

▶ **Explanation:** Membrane and secreted proteins enter the endomembrane system co-translationally at the rough ER, then traffic through the Golgi before reaching the plasma membrane.

2 **Which function is most specifically associated with the smooth endoplasmic reticulum in hepatocytes (liver cells)?**

A Attachment of ribosomes and synthesis of secreted proteins.

B **Detoxification of lipid-soluble drugs and poisons.** ✓

C Packaging of proteins into clathrin-coated vesicles.

D Digestion of worn-out organelles.

E Formation of the mitotic spindle.

▶ **Explanation:** Smooth ER in liver cells is enriched in detoxifying enzymes (such as cytochrome P450) that modify lipid-soluble compounds to make them more water-soluble.

3 **In skeletal muscle cells, the sarcoplasmic reticulum is a specialized form of endoplasmic reticulum that primarily functions to:**

A Synthesize contractile proteins actin and myosin.

B **Store and release Ca^{2+} to regulate muscle contraction.** ✓

C Produce ATP via oxidative phosphorylation.

D Generate action potentials.

E Degrade damaged myofibrils by autophagy.

▶ **Explanation:** The sarcoplasmic reticulum is a smooth ER derivative specialized for Ca^{2+} storage and release, which triggers muscle contraction.

4 **If the signal recognition particle (SRP) in a eukaryotic cell is nonfunctional, which class of proteins is most immediately affected?**

A Enzymes of glycolysis in the cytosol.

B DNA polymerases in the nucleus.

C **Secreted proteins that normally enter the rough ER during translation.** ✓

D Mitochondrial matrix enzymes imported after translation.

E Cytoskeletal proteins such as actin.

▶ **Explanation:** SRP recognizes signal peptides emerging from ribosomes and targets the ribosome-nascent chain complex to the ER; without SRP, secretory and many membrane proteins fail to enter the ER.

5 **Which statement correctly describes the initiation of translation for proteins that will be secreted from the cell?**

A Translation begins on ribosomes already bound to the rough ER membrane.

B **Translation begins on free ribosomes and the ribosome-nascent chain complex is then targeted to the rough ER.** ✓

C Translation occurs only inside the Golgi apparatus.

D Translation occurs in the nucleus to allow direct entry of mRNA into the ER.

E Translation is completed in the cytosol and proteins later diffuse into the ER lumen.

▶ **Explanation:** All translation initiates on free ribosomes; the presence of an ER signal sequence causes the ribosome-polypeptide complex to be directed to the rough ER membrane.

6 A single-pass transmembrane protein has its N-terminus in the lumen of the rough ER and its C-terminus in the cytosol during synthesis. After it reaches the plasma membrane, where will its N-terminus be located?

A Facing the cytosol.

B **Facing the extracellular space.** ✓

C Facing the mitochondrial matrix.

D Facing the nuclear interior.

E Randomly facing either the cytosol or extracellular space with equal probability.

▶ **Explanation:** The ER lumen is topologically equivalent to the extracellular space; the orientation of membrane proteins is preserved as vesicles move from ER to Golgi to plasma membrane, so the luminal domain becomes extracellular.

7 In a secretory cell, misfolded proteins accumulate in the rough ER because their disulfide bonds cannot form properly. Which response is most directly triggered at the level of the ER?

A Formation of more lysosomes to digest misfolded proteins in the cytosol.

B **Activation of the unfolded protein response, including upregulation of ER chaperones.** ✓

C Immediate fusion of the ER with the plasma membrane to expel misfolded proteins.

D Conversion of rough ER into smooth ER by loss of ribosomes.

E Direct degradation of misfolded proteins by mitochondrial proteases.

▶ **Explanation:** Accumulation of misfolded proteins in the ER triggers the unfolded protein response (UPR), which increases expression of chaperones, reduces general translation, and enhances degradation pathways to restore ER homeostasis.