Name: _____ **Date:** _____

Getting High-Strung Over Hypertonic Solutions: 11th Grade Cytology

Surface area-to-volume ratios, endosymbiosis evidence, and specialized membrane protein kinetics. Students will evaluate complex physiological scenarios to analyze how organelle malfunctions disrupt cellular homeostasis.

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1. A researcher observes a cell with an unusually high density of Smooth Endoplasmic Reticulum (SER). In which of the following specialized human cells would this most likely be an adaptive feature?

A. A pancreatic acinar cell producing digestive proteases
B. A Leydig cell in the testes responsible for testosterone synthesis
C. A B-lymphocyte secreting high volumes of antibodies
D. A mature erythrocyte optimizing oxygen transport

2. The _____ theory is supported by the fact that mitochondria and chloroplasts possess their own circular DNA and 70S ribosomes, similar to modern prokaryotes.

A. Chemiosmotic
B. Endosymbiotic
C. Particulate
D. Spontaneous Generation

3. As a cell increases in size, the surface area-to-volume ratio decreases, significantly limiting the efficiency of diffusion-based nutrient exchange.

A. True
B. False

4. If a mutation causes a defect in the Signal Recognition Particle (SRP) that docks with the Rough ER, where would proteins destined for secretion most likely accumulate?

A. In the lumen of the Golgi apparatus
B. Attached to the transport vesicles
C. Within the cytosol
D. Inside the mitochondrial matrix

5. The movement of water through _____ proteins is a form of facilitated diffusion that allows cells to regulate osmotic pressure faster than simple diffusion.

A. Integrin
B. Aquaporin
C. Sodium-Potassium Pump
D. F1-ATPase

6. Lysosomal enzymes, such as acid hydrolases, are most active at a neutral pH of 7.0 found in the general cytoplasm.

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A. True
B. False

7. A patient is diagnosed with a disorder characterized by the inability to break down very-long-chain fatty acids (VLCFAs). Which organelle is most likely dysfunctional?

A. Nucleolus
B. Peroxisome
C. Golgi complex
D. Centrosome

8. In the fluid mosaic model, _____ molecules act as a 'fluidity buffer,' preventing the membrane from becoming too rigid in cold temperatures or too fluid in heat.

A. Glycoprotein
B. Cholesterol
C. Peripheral protein
D. Phospholipid

9. Which of the following scenarios best describes the role of the cytoskeleton in maintaining cellular function during mitosis?

A. Actin filaments forming the contractile ring during cytokinesis
B. Intermediate filaments providing the energy for DNA replication
C. Microtubules synthesizing the new nuclear envelope
D. Cilia moving chromosomes to opposite poles

10. Active transport is the only mechanism of cellular transport that requires the direct or indirect expenditure of metabolic energy (ATP).

A. True
B. False