Name: _____ **Date:** _____

Answer Key: Dissect the Living Architecture: 12th Grade Advanced Cytology Quiz

Synthesize complex interactions between endomembrane systems and energetic organelles to evaluate cellular homeostasis and signaling pathways.

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1. In the context of the Endosymbiotic Theory, which piece of evidence best supports the autonomous nature of mitochondria and chloroplasts within a eukaryotic host?

Answer: B) The existence of circular DNA and 70S ribosomes within the organelle matrix.

Circular DNA and 70S ribosomes are characteristic of prokaryotes, supporting the theory that these organelles originated as engulfed aerobic or photosynthetic bacteria.

2. The _____ is a specialized compartment in plant cells that contains enzymes for the glyoxylate cycle, converting stored lipids into carbohydrates for the emerging seedling.

Answer: C) Glyoxysome

Glyoxysomes are a type of microbody (peroxisome) found in fat-storing tissues of plant seeds, essential for energy mobilization during germination.

3. Consider a mutation that renders the signal recognition particle (SRP) non-functional. Predict the immediate consequence for the cell's proteome.

Answer: C) Endomembrane and secretory proteins will be translated in the cytosol instead of the ER.

The SRP is responsible for docking ribosomes to the Rough ER; without it, proteins destined for secretion or membrane insertion cannot be localized to the ER membrane.

4. The Fluid Mosaic Model posits that the lateral mobility of integral membrane proteins is entirely unrestricted across the entire surface of the cell membrane.

Answer: B) False

Mobility is often restricted by membrane domains like lipid rafts or by physical attachment to the underlying cytoskeleton (scaffolding).

5. Which cytoskeletal element is characterized by its dynamic instability and plays a critical role in the spatial organization of organelles and chromsome segregation?

Name: _____ **Date:** _____

Answer: C) Microtubules

Microtubules exhibit dynamic instability (rapid growth and shrinkage) and form the spindle apparatus for mitosis and tracks for intracellular transport.

6. In the process of autophagy, the _____ fuses with an autophagosome to facilitate the enzymatic degradation of dysfunctional cytoplasmic components.

Answer: B) Lysosome

Lysosomes contain hydrolytic enzymes (acid hydrolases) that break down macromolecules and old organelles via fusion.

7. Desmosomes are specialized cell junctions that primarily facilitate the rapid electrical coupling and chemical exchange between neighboring cardiac muscle cells.

Answer: B) False

Desmosomes provide mechanical strength; gap junctions are the structures responsible for electrical and chemical coupling between cells.

8. How does the Smooth Endoplasmic Reticulum facilitate homeostatic balance in hepatocytes (liver cells) following toxin exposure?

Answer: C) By adding hydroxyl groups to drug molecules to increase their solubility.

The Smooth ER contains enzymes like Cytochrome P450 which detoxify compounds by making them more polar/water-soluble for renal excretion.

9. The _____ face of the Golgi apparatus is the primary receiving site for vesicles arriving from the Endoplasmic Reticulum.

Answer: B) Cis

The 'cis' face is the receiving side (oriented toward the ER), while the 'trans' face is the shipping side (oriented toward the plasma membrane).

10. Cholesterol functions as a bidirectional regulator of membrane fluidity, preventing excessive rigidity at low temperatures and excessive fluidity at high temperatures.

Answer: A) True

Name: _____ **Date:** _____

Cholesterol acts as a 'fluidity buffer' by disrupting the packing of phospholipids in the cold and restricting their movement in the heat.