



HUMAN ANATOMY AND PHYSIOLOGY - (BP101T)

Case Study Puzzles – Unit 1

1. Levels of Structural Organization

A 45-year-old man with chronic kidney disease shows reduced filtration of blood and swelling due to water retention. The nephron cells are damaged, kidney tissues are scarred, and overall urine output is low.

Puzzle: At which structural levels (cell, tissue, organ, organ system) is the defect most prominently seen?

2. Osmosis in Red Blood Cells

A patient admitted for dehydration is mistakenly given an intravenous drip of distilled water instead of saline. Within minutes, he develops hemolysis, leading to weakness and low oxygen levels.

Puzzle: Which type of transport process across the cell membrane explains the bursting of red blood cells?

3. Mitochondrial Disorder

A young boy frequently complains of tiredness and muscle weakness. Blood tests show that his muscle cells have low ATP production despite normal oxygen supply. Doctors suspect a defect in oxidative phosphorylation.

Puzzle: Which organelle is malfunctioning, and what is its key role in the cell?

4. Uncontrolled Cell Division

A 52-year-old woman develops a tumor in her breast. Biopsy shows rapid, uncontrolled multiplication of cells without normal regulation. Doctors confirm cancer due to failed control of the cell cycle.

Puzzle: Which cell cycle checkpoint is likely defective, leading to uncontrolled division?

5. Cell Junctions in the Intestine

During endoscopy, doctors find that digestive enzymes in a patient are leaking into spaces between intestinal cells, causing local tissue irritation. Normally, this leakage is prevented by specialized cell junctions.

Puzzle: Which type of cell junction prevents leakage between epithelial cells?

6. Endocrine Signaling – Adrenaline Rush

A college student preparing for exams suddenly feels his heart racing, palms sweating, and breathing rate increasing. Tests reveal elevated adrenaline in his bloodstream, secreted from adrenal glands during stress.

Puzzle: Which type of intracellular signaling mechanism explains adrenaline's action on multiple organs at once?

7. Nerve Conduction Problem

A 30-year-old woman with multiple sclerosis develops weakness and loss of coordination. Scans show demyelination of neurons, slowing down electrical conduction between nerve cells.

Puzzle: Which form of cell communication is impaired, and what role does myelin normally play?

8. Epithelial Adaptation in Smokers

A chronic smoker complains of persistent cough and breathlessness. Examination reveals that his normal ciliated respiratory epithelium has been replaced by stratified squamous epithelium. This change reduces mucous clearance from the airways.

Puzzle: What adaptive cellular process has occurred in his airway epithelium?

9. Bone Weakness in Osteoporosis

A 70-year-old woman suffers repeated fractures even from minor falls. Scans reveal reduced calcium deposition and weakening of her bone matrix.

Puzzle: Which connective tissue is affected, and what is its normal structural function?

10. Cardiac Muscle Limitation

A patient who survived a heart attack develops scarring of the heart wall. Doctors explain that the lost cardiac muscle cells cannot regenerate and are replaced with fibrous connective tissue.

Puzzle: Why is cardiac muscle unable to regenerate like smooth muscle tissue?