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UNDERSTANDING TISSUES. EPITHELIAL HISTOMORPHOLOGY

Abstract: Epithelial tissue is one of the fundamental tissue types in the human body, playing crucial roles in protection, absorption, secretion, and sensation. The histomorphology of epithelial tissue is characterized by a high cellular density, polarity, and specialized structures such as cilia and microvilli. Epithelial cells are classified based on the number of layers (simple, stratified, pseudostratified, and transitional) and cell shape (squamous, cuboidal, columnar, and transitional). These tissues are often avascular, relying on diffusion for nutrient supply, and have a high regenerative capacity. The basement membrane, composed of basal and reticular laminae, supports the epithelium and provides a connection to underlying connective tissues. Epithelial tissue is found in various locations throughout the body, each specialized for specific functions such as protection (skin), absorption (intestinal lining), secretion (glands), and filtration (kidneys). This tissue type's unique structural characteristics allow it to perform vital physiological processes efficiently and effectively.

Key words: Epithelial tissue, histomorphology, cell layers, cell shapes, basal membrane, polarity, absorption, secretion, protection, regeneration, specialized structures, cilia, microvilli, stratified epithelium, simple epithelium, squamous epithelium, cuboidal epithelium, columnar epithelium, transitional epithelium, basement membrane, avascularity.

Epithelial tissue is one of the four primary tissue types in the human body and is integral to the structure and function of various organs and systems. It forms protective barriers, facilitates absorption, aids in secretion, and is involved in sensation and excretion. Epithelial tissue lines the surfaces of the body and organs, both externally and internally, and is typically composed of tightly packed cells with minimal extracellular matrix. The histomorphology of epithelial tissue is characterized by its distinct cellular organization, which can vary based on cell shape, arrangement, and function.

Epithelial cells exhibit polarity, meaning they have distinct apical, basal, and lateral surfaces, each specialized for different functions. These tissues are classified based on the number of cell layers (simple, stratified, pseudostratified, and transitional) and the shape of the cells (squamous, cuboidal, columnar, and transitional). Epithelial cells are highly regenerative, which enables the rapid repair of damaged tissue. Moreover, these tissues lack direct blood supply (avascularity) and rely on diffusion for nutrients from underlying connective tissues.[2]

The basement membrane plays a critical role in anchoring epithelial cells to the underlying tissue, maintaining structural integrity, and facilitating cell signaling. Epithelial tissue's ability to adapt

to various physiological functions makes it essential for the proper functioning of many organs, including the skin, digestive tract, respiratory system, and urinary system. Understanding the histomorphology of epithelial tissue provides insight into how these tissues contribute to homeostasis and respond to injury and disease.

Structure and Organization of Epithelial Tissue

Epithelial tissue is composed of closely packed cells that form continuous layers with minimal extracellular matrix. These cells are typically polarized, meaning they have distinct apical, basal, and lateral surfaces.[3] The apical surface faces the external environment or the lumen of a body cavity, while the basal surface is attached to a specialized extracellular structure called the **basement membrane**. The lateral surfaces are in contact with adjacent epithelial cells and are often joined by specialized junctions, including **tight junctions**, **desmosomes**, and **gap junctions**. These junctions play crucial roles in maintaining the integrity and permeability of the epithelium. The **basement membrane** consists of two layers: the **basal lamina**, produced by epithelial cells, and the **reticular lamina**, produced by the underlying connective tissue. This structure not only anchors the epithelium but also serves as a filter and provides mechanical support.

Classification of Epithelial Tissue

Epithelial tissue is classified into different types based on the number of cell layers and the shape of the cells.

By Number of Layers:

- **Simple epithelium:** A single layer of cells that allows for efficient diffusion, filtration, absorption, or secretion. Found in areas such as the lining of blood vessels (endothelium), alveoli in the lungs, and the renal tubules.
- **Stratified epithelium:** Composed of multiple layers of cells, designed for protection against mechanical stress and abrasion. It is found in areas such as the skin (epidermis) and the lining of the esophagus and vagina.
- **Pseudostratified epithelium:** Appears to have multiple layers due to the varying positions of nuclei, but all cells are in contact with the basement membrane. This type is commonly found in the respiratory tract, where it helps with mucus movement via cilia.
- **Transitional epithelium:** Specialized for stretching and found in areas like the urinary bladder and ureters, where it accommodates changes in volume.

By Cell Shape:

- **Squamous epithelium:** Cells are flat and scale-like, which facilitates processes like diffusion and filtration. Simple squamous epithelium lines structures such as blood vessels and the alveoli in the lungs, while stratified squamous epithelium forms the outer layers of the skin.
- **Cuboidal epithelium:** Cells are cube-shaped and typically involved in secretion and absorption. Simple cuboidal epithelium can be found in the glands and kidney tubules.
- **Columnar epithelium:** Cells are taller than they are wide, often specialized for absorption and secretion. Simple columnar epithelium lines the digestive tract, where it aids in nutrient absorption.
- **Transitional epithelium:** This type of epithelium consists of cells that change shape depending on stretching. It is found in the urinary system, where it allows for expansion and contraction of organs like the bladder.[4]

Epithelial tissue is a diverse and essential component of the body, performing numerous functions related to protection, absorption, secretion, and sensation. The histomorphology of epithelial tissue,

including its cellular organization, polarity, and specialized structures, allows it to fulfill these roles effectively. The regenerative capacity and avascular nature of epithelial tissue further contribute to its ability to maintain homeostasis and adapt to changes. Understanding the structure and function of epithelial tissue is crucial for comprehending its role in health and disease.

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