

# Epithelium

Epithelial tissue is one of the four basic types of tissue in the human body. It is made up mainly of cells, with a small amount of intercellular matter. Epithelial cells have significant intercellular junctions and are polarized. With few exceptions, they are avascular, nourished by diffusion, and lie on the basement membrane. Epithelial tissues perform a variety of functions, which is why they have very diverse morphologies – they cover surfaces, resorb or secrete substances from one compartment to another, and have immune functions. The epithelium is therefore not just a "layer of cells on the surface", it forms, for example, a substantial part of the mass of the liver or spleen.

## Characteristics

- **apicobasal polarization** – the cell has two poles differing in its biochemical composition and function
  - apical pole – the apical part of the membrane
  - basal pole – basolateral part of the membrane
- **intercellular junctions** – together with cohesive forces (mediated, among other things, by integral proteins of cell membranes and calcium ions) participate in the **adhesion** of epithelial cells, create a **barrier** for the penetration of substances via the paracellular route and also enable **intercellular communication**
  - **zonula occludens** (tight junctions) – the most apical; they create a barrier, the number of these connections determines the degree of permeability of the epithelium; formed by the proteins occludin and claudin; creates a boundary between the apical and basolateral surfaces of the cell
  - **zonula adhaerens** – mainly involved in cell adhesion; structurally, they are actin microfilaments emerging from plates formed by myosin, tropomyosin, alpha-actinin and vinculin
  - **nexus** (gap junction) – they mediate intercellular communication by enabling the exchange of substances (e.g. AMP, calcium ions); structurally, these are proteins grouped into hexamers (**connexon**)
  - **desmosomes** (macula adhaerens) – desmosomes are spread along the lateral membranes of cells; participate in cell adhesion; a discoid structure with a plaque (attachment plate) on the inner side of the membrane where the intermediate filaments attach
- **basement membrane** – the basal surface of epithelial cells sits on the basement membrane, which anchors the epithelium to the subepithelial ligament; creates an interface between the tissue and the epithelium

## Surface specialization

- structures typically occurring on the basal or apical surface are related to the function of the given epithelium
  - **apical surface** :
    - **brush bordering** (also annealed) – formed by densely arranged microvilli; typically in resorptive epithelia, where it increases the surface, i.e. its function of absorption
    - **stereocilia** – long microvilli (reaching up to 10  $\mu\text{m}$ ); on the epithelium of the male genital tract, on the hair cells of the inner ear
    - kinocilia (cilia) – they are found in the so-called **ciliated epithelia** (typically in the respiratory tract, in the fallopian tube), where they densely cover the apical surface of the epithelial cells; with metachronous oscillations, they enable the movement of fluids or mucus
    - **microalgae** – on stratified squamous epithelium
  - **basolateral surface** :
    - **basal labyrinth** : invagination of cytoplasmic membrane containing mitochondria; for active ion transport; eg in the proximal and distal renal tubules
    - **finger-like projections**

## Division of epithelia

- **According to spatial arrangement** :
  - **squamous**:
    - **single-layered** (all cells are attached to the basement membrane):
      - tiled (flat) – the width of the cell is greater than its height; polygonal cell shape
      - cubic – the width, height and depth of the cell are approximately the same size
      - cylindrical – the height of the cell noticeably exceeds its width
      - multi-rowed cylindrical – all cells sit on the basement membrane, but not all of them reach the free surface of the epithelium, it appears as stratified, which is why it is sometimes called pseudostratified epithelium; consists of cells performing the given function and of lower **basal cells** that grow and serve to renew the epithelium
    - **multi-layered** :
      - tilted
      - cubic
      - cylindrical



Multilayered columnar epithelium of airways

- **beamy**
- **reticular**
- **By function :**
  - covering
  - absorptive
  - respiratory
  - sensory
  - muscular myoepithelium
  - germinal
  - glandular

**The covering epithelium** is a specialized tissue used to cover the surfaces and line the cavities of the human body. It protects the external and internal surface of the body and organs, it is very resistant to mechanical, thermal and chemical influences.

**The glandular epithelium** forms the functional basis of the glands. It consists of cells capable of receiving substances, processing them and excreting the created product.

Covering and glandular epithelia are considered two major groups of epithelia.

## Covering epithelium

We classify them according to:

- number of cell layers
- cell shape - in stratified epithelia, the uppermost layer is essential

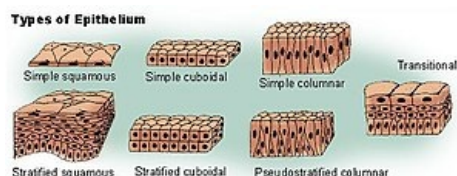
### Single-layered epithelium

Cell shape	Occurrence	Function
<b>flat (tiled)</b>	pleura, pericardium, peritoneum, kidneys, endothelium	active transport by pinocytosis
<b>cubic</b>	thyroid follicles , ovarian surface , glandular ducts, distal tubules of the nephron	covering function, secretion
<b>cylindrical (prismatic)</b>	digestive tract from cardia to columnae anales, fallopian tube, uterus	protection, resorption, secretion
<b>multi-row cylindrical with cilia</b>	nasal cavities, trachea, bronchi	secretion, transport of trapped particles from the respiratory tract

### Stratified epithelium

- has 2 or more layers

Cell shape	Occurrence	Function
<b>flat (tiled) keratinizing</b>	epidermis	protection
<b>flat (tiled) non-keratinizing</b>	oral cavity, esophagus, larynx, vagina, glans penis, anal canal	protection, prevention of water losses
<b>cubic</b>	sweat glands, developing follicles	protection, secretion
<b>cylindrical</b>	conjunctival sac	protection
<b>transitional (urotel)</b>	bladder	protection, extensibility



## Links

### Related Articles

- Cartilage
- Bone
- Ligament
- Sensory epithelium
- Absorptive epithelium
- Glandular epithelium
- Endothelium
- Mesothelium

## References

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