الجمهورية الجزائرية الديمقراطية الشعبية

جامعة جيجل

محمد الصديق بن يحيى

University of JIJEL

HISTOLOGY

Présenter par : Dr. BOUAMEUR Somia

Presented by: Dr. BOUAMEUR Somia

somia.bouameur@univ-jijel.dz

2024/2025

Histology

Histology is the science that studies the microscopic structure of biological tissues. It enables us to understand how cells are organized into tissues, then into organs, and their role in the functioning of the human body.

Etymological origin (from Greek: *histos* = tissue, *logos* = study)

It is most commonly based on the examination of very thin sections observed under a microscope.

Importance in Medicine

Histology is a fundamental discipline for future physicians, because it:

- Bridges cellular biology and macroscopic anatomy
- Allows the distinction between healthy and pathological tissues (basis of histopathological diagnosis)
- Helps understand the mechanisms of diseases (inflammation, cancer, degeneration, etc.)
- Is indispensable for interpreting biopsies

What is a tissue?

• A tissue is an organized set of specialized cells of the same embryonic origin that perform a common biological function.

• These cells are often interconnected by an extracellular matrix (ECM) (ground substance and fibers) and display a structure adapted to their function.

• **Tissue = Cell + ECM** (except for epithelia).

Biological tissues, endowed with regenerative capacity, differentiate and arrange themselves to form organs, whose hierarchical organization gives rise to complex physiological systems.

Plan

- ❖ **COVERING EPITHELIA**
- ❖ **GLANDULAR EPITHELIA**
- ❖ **CONNECTIVE TISSUE**
- ❖ **CARTILAGINOUS TISSUE**
- ❖ **OSSEOUS (BONE) TISSUE**
- ❖ **BLOOD TISSUE**

COVERING EPITHELIA

• They are composed exclusively of closely juxtaposed, contiguous cells, with no interposition of ECM.

• Cells are held together by: intercellular junctions (desmosomes, gap junctions, etc.) + interdigitations + intercellular cement (at the basal pole).

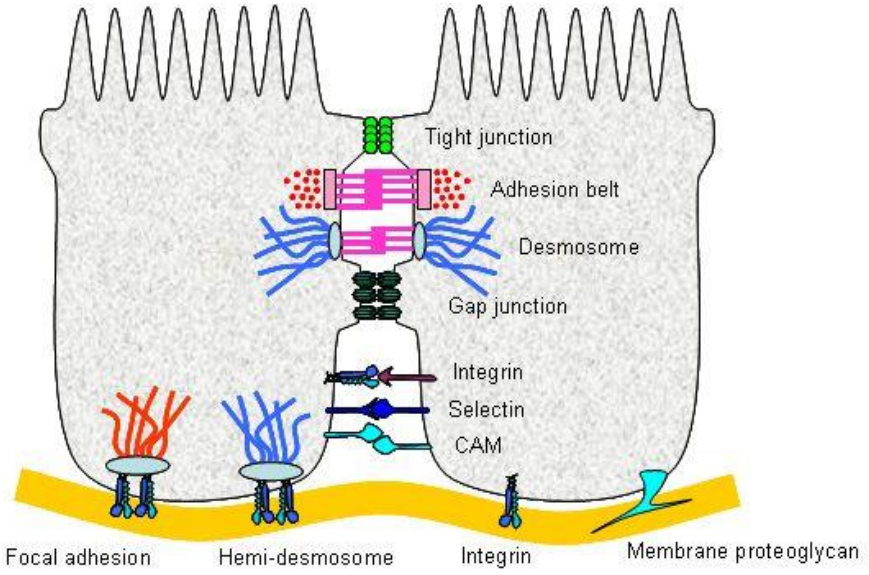


Figure 1: Intercellular junctions

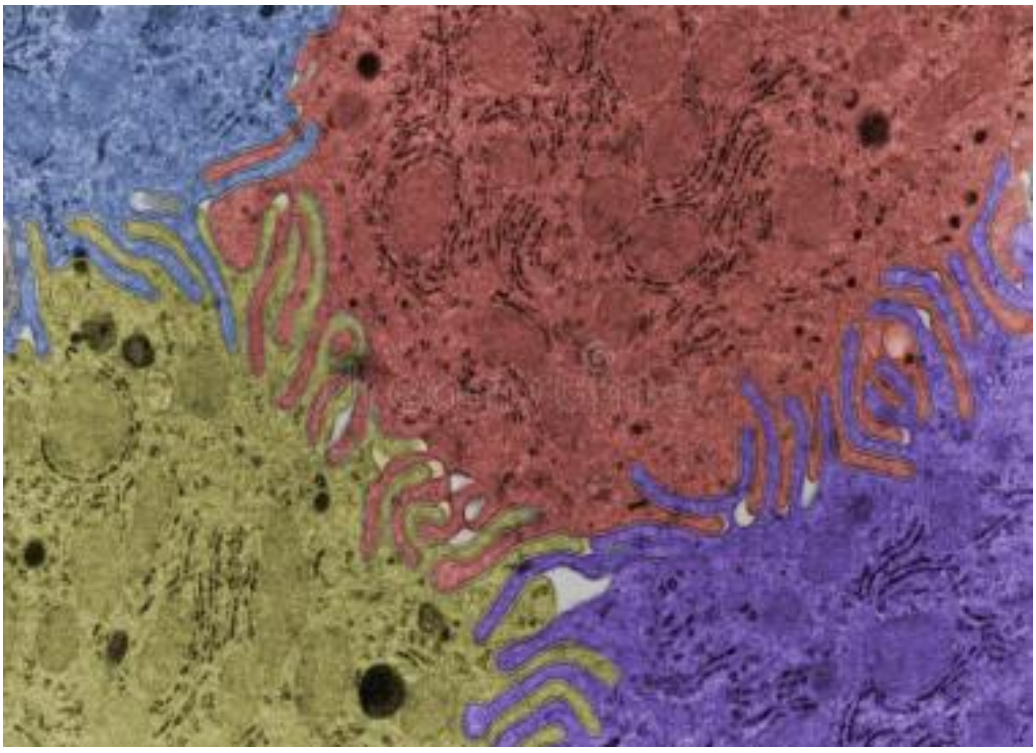


Figure 2: Interdigitations

• They are avascular. The supply of nutrients and removal of waste occurs in relation with the underlying connective tissue via a **basement membrane**, on which every epithelium rests.

The Basement Membrane

An anchoring structure composed of 2 main parts:

• **Lamina lucida** (or **rara**) (electron-lucent layer): – Integrins (anchoring of epithelial cells via hemidesmosomes) – Nidogen/Entactin (links laminin to collagen IV)

• **Lamina densa** (electron-dense layer): – Type IV collagen (network-forming resistant structure) – Laminin (adhesive glycoprotein) – Proteoglycans (such as perlecan, which regulates permeability)

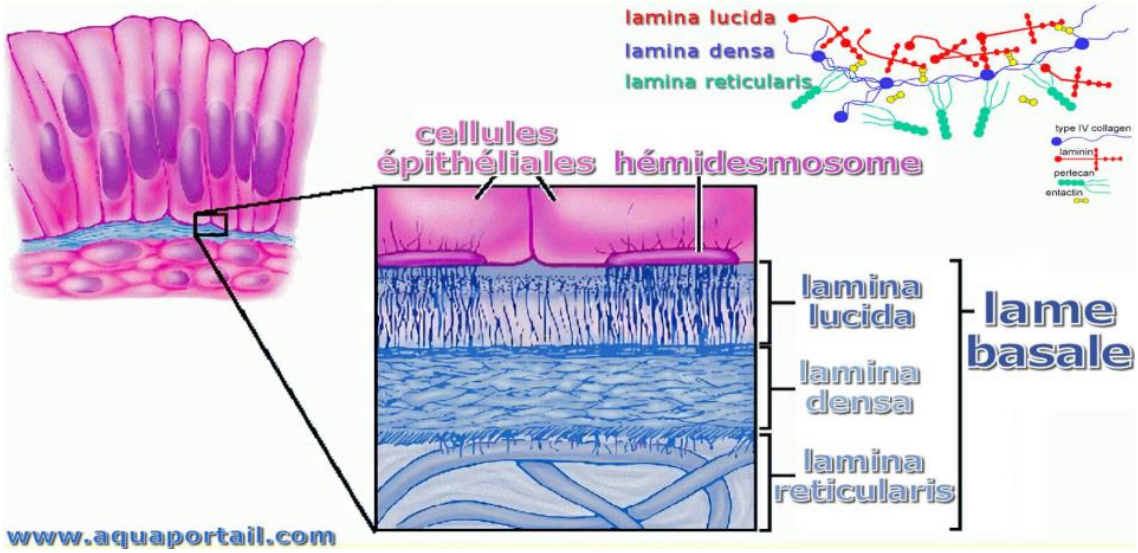


Figure 3: Components of the basement membrane

Role and Distinction

→ Basement membrane (anchoring / filtration)

→ Connective tissue (support / immunity)

■ Role of the sub-epithelial connective tissue: nutrition + signaling + nerve endings.

Two main types of epithelia are distinguished:

→ Covering Epithelium

– Lines cavities (stomach), ducts (intestine), and blood vessels.

– Covers the entire body surface (the skin: epidermis + dermis + hypodermis).

→ Glandular Epithelium

– Either grouped into organs (salivary glands),

– Or associated with a covering epithelium (glands of the digestive mucosa),

– Or unicellular elements within a covering epithelium (goblet cells).

There are two types:

- **Exocrine:** secrete their product into the extracellular environment.
- **Endocrine:** release their product into the blood or lymph.

Embryological Origin of Covering Epithelia

Covering epithelia are derived from the 3 embryonic germ layers:

- **Ectoderm** → epidermis. The entire organism is covered by the skin. This covering epithelium is the epidermis.
- **Endoderm** → respiratory, digestive, and urinary systems, etc. 'Open' cavities (extensions of the exterior), such as the airways, digestive tract, urinary tract, and genital tract, are lined by an epithelium.
- **Mesoderm** → endothelia of 'closed' cavities + mesothelia of coelomic cavities. 'Closed' cavities such as cardiac and vascular cavities (blood and lymphatic vessels) are lined by an *endothelium*. Coelomic cavities such as the pleural, peritoneal, and pericardial cavities are lined by a *mesothelium*.

Morphological Classification of Covering Epithelia

The classification of covering epithelia is based on three morphological criteria:

- The shape of epithelial cells
- The number of cell layers
- The nature of specializations

1/ Shape of Epithelial Cells

- **Squamous cell** (flattened): wider than tall, with a flattened nucleus.
- **Isoprismatic cell** (cuboidal): equal height and width, with a rounded nucleus.
- **Prismatic cell** (columnar): taller than wide, with an elongated nucleus.

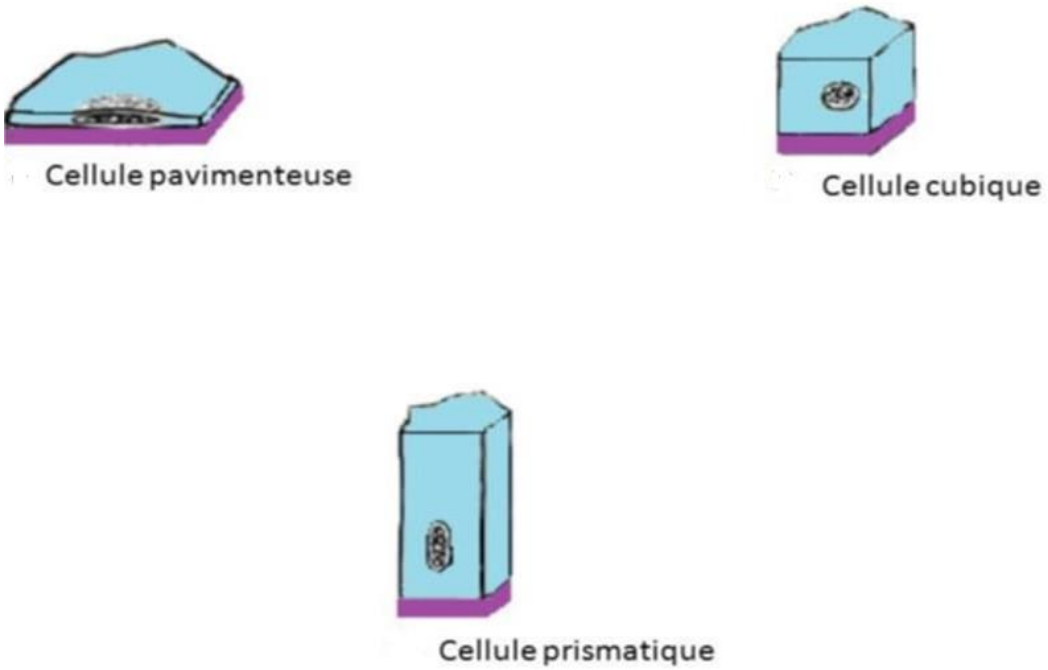


Figure 4: Shapes of epithelial cells

2/ Number of Cell Layers

The number of cell layers allows distinction of the following epithelial types:

- **Unistratified (simple):** a single layer of cells, all resting on the basement membrane.

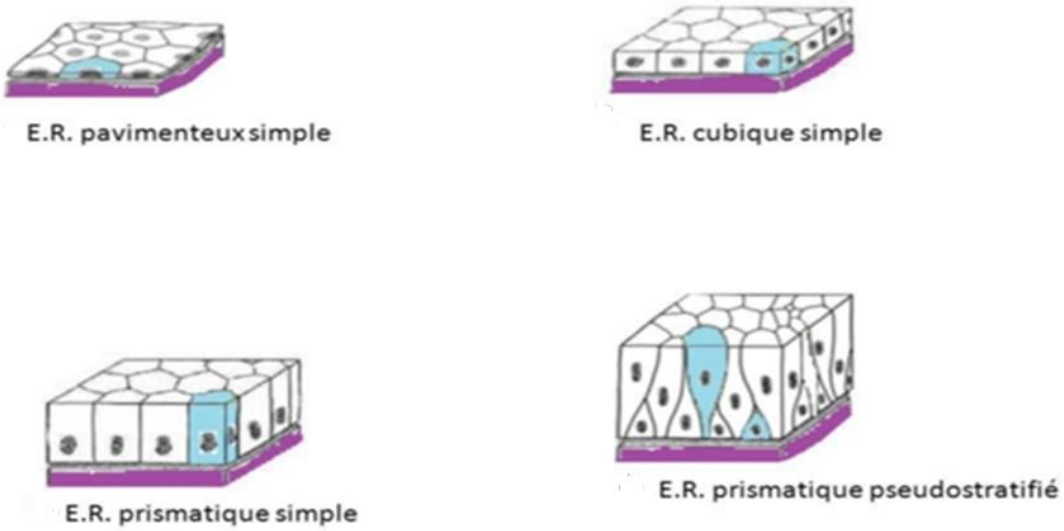
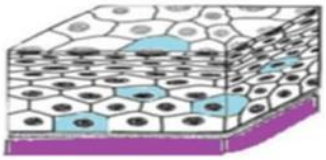


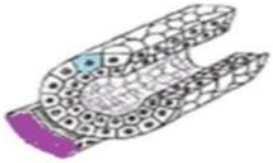
Figure 5

- **Pluristratified (stratified):** formed of several layers of cells; only the basal (germinative) layer rests on the basement membrane.



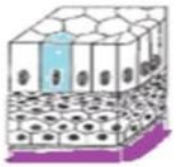
E.R. pavimenteux stratifié

Epiderme



E.R. cubique stratifié

canal excreteur



E.R. prismatique stratifié

nasopharynx

Figure 6

• **Pseudostratified:** all cells are in contact with the basement membrane, but only some reach the lumen; furthermore, the nuclei are not all at the same level.

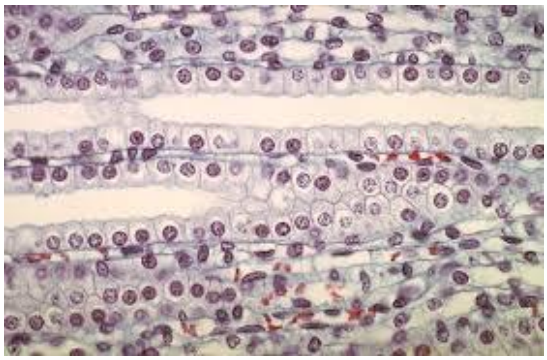


Figure 7

Examples: respiratory covering epithelia, epididymal duct, and urinary bladder.

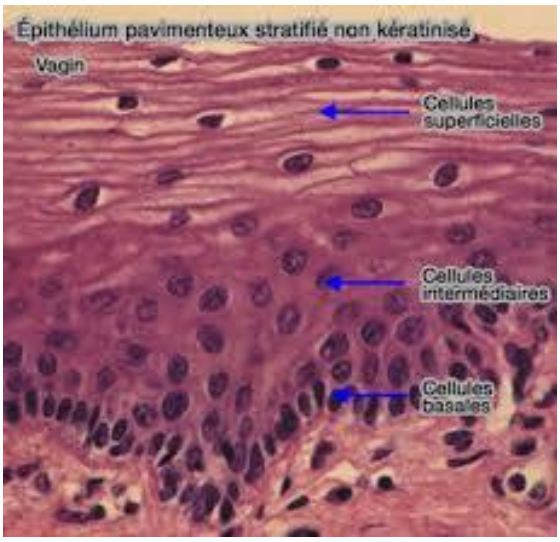


Figure 8: Pluristratified isoprismatic epithelium

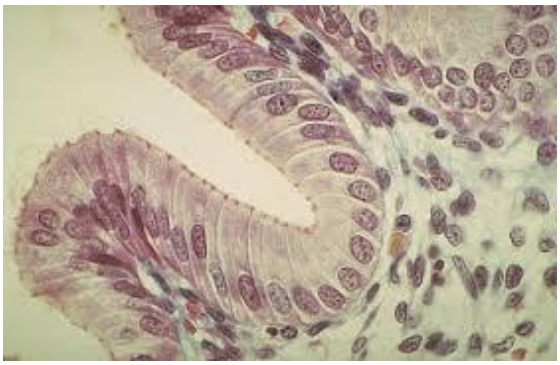


Figure 9: Pluristratified squamous epithelium

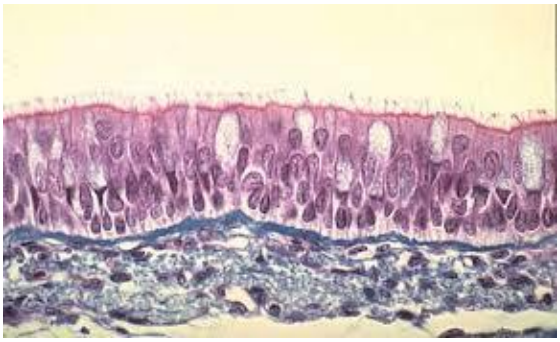


Figure 10: Simple prismatic epithelium

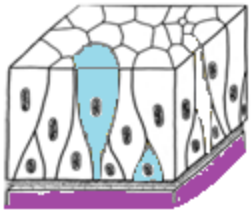


Figure 11: Pseudostratified epithelium

3/ Nature of Specializations

➤ Invaginations / Basal Specializations:

These increase the exchange surface with the adjacent connective tissue, to which they are linked by anchoring devices. Often associated with mitochondria and less specialized than at the apical pole (e.g., renal cell).

➤ Evaginations / Apical Specializations:

Microvilli: short, bounded by the apical plasma membrane. Irregular in length and arrangement. Maintained by actin microfilaments.

Properties of Covering Epithelia

- **Nutrition:** avascularized (contain no blood vessels); they depend on:
  - – Passive diffusion from the underlying connective tissue, rich in blood capillaries.
  - – The basement membrane, which serves as a filter and support for exchanges.
- Nerve endings are very abundant.
- **Renewal / Regeneration** occurs by mitosis from stem cells.

Regeneration occurs:

- ■ **In simple covering epithelia:** isolated stem cells are intercalated between ordinary cells.
- ■ **In pseudostratified covering epithelia:** they are basal and isolated.
- ■ **In stratified covering epithelia:** stem cells constitute the germinative basal layer (the deepest layer).

Functions of Covering Epithelia

➤ Protective functions:

- Mechanical (against mechanical trauma of the epidermis)
- Chemical (against acid and enzymatic aggressions in the stomach)
- Physical (against harmful light radiation of the epidermis)

➤ Exchange and transport functions:

- Active absorption for the intestinal covering epithelium via the striated border.
- Absorption, excretion, and ionic exchange for the renal tubular epithelium via the brush border and basal invaginations.