

VIII. HISTOLOGY

I. Introduction :

Histology, or microscopic anatomy, is the study of tissues, both descriptively and functionally.

The term tissue refers to a group of cells with the same shape (rounded, rectangular, etc.), the same structure (same organelles) and the same physiology (origin, development, lifespan, function). A tissue is a group of cells, an organ is a group of tissues and a system is a group of organs, for example: all the cardiac cells form the heart (an organ), and the heart, arteries, veins and capillaries together form the cardiovascular system.

Tissue should not be confused with organ: an organ is made up of several different tissues (the stomach is made up of epithelial tissue, muscle tissue, nerve tissue and connective tissue). The same tissue can be found in several different organs Epithelial lining tissue is found wherever there is contact with the outside world or in contact with a cavity, such as on the surface of the skin, inside the stomach, around the heart, etc.).

A tissue can be a simple tissue or a compound tissue. Four basic types of tissue can be distinguished on the basis of their mode of development, structure and function:

1. Epithelial tissue
2. Connective tissue
3. Muscular tissue (striated skeletal, smooth, cardiac)
4. Central and peripheral nervous tissue

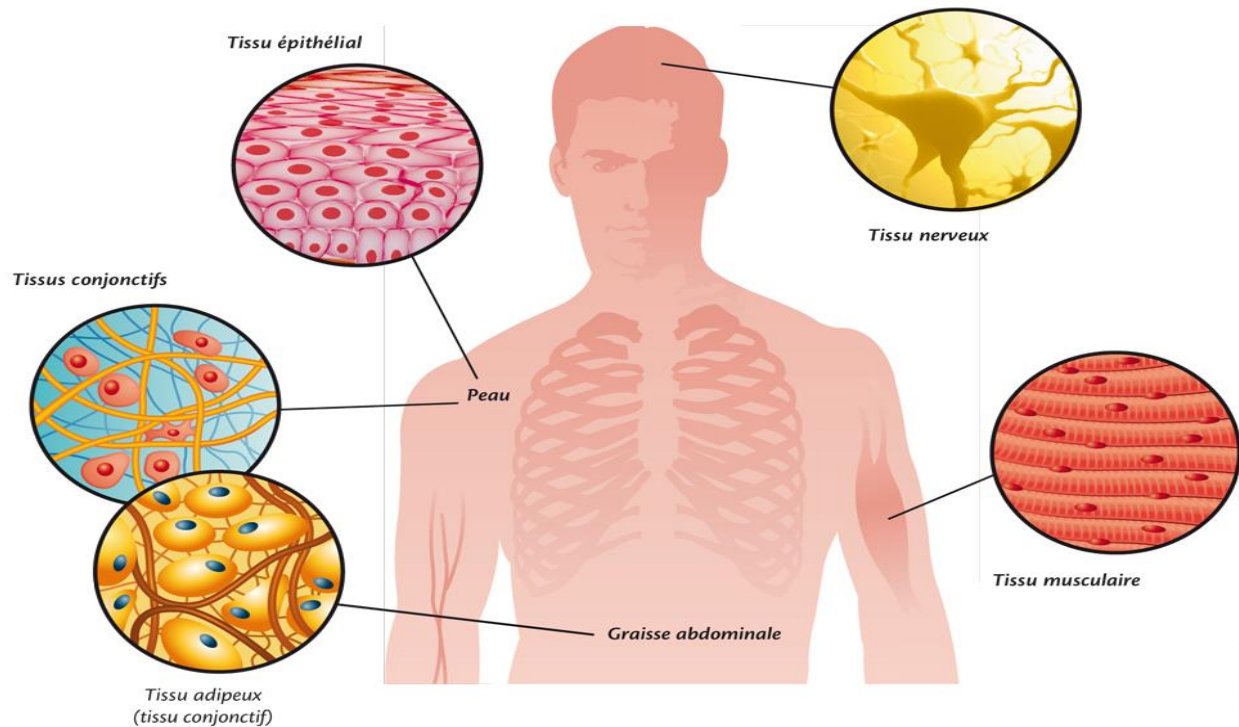


Figure 01: The different tissues in the body.

II.EPITHELIAL TISSUE

II.1 Definition :

Epithelial tissue is a collection of juxtaposed cells, held together by junction systems and separated from connective tissue by a basement membrane. The epithelia establish a barrier between two environments of different natures. Epithelial cells come in a wide variety of shapes and sizes.

Epithelia have two main functions:

- They line the body's cavities and surface. These are the lining epithelia.
- They constitute glandular elements which may be either grouped together in organs (salivary glands, liver, endocrine glands), or associated with a lining epithelium (glands of the digestive or respiratory mucosa) or single-cell elements in an epithelium elements in a covering epithelium (caliciform cells). These are the glandular epithelia.

II.2 Lining epithelia :

The body is entirely bounded by the cutaneous covering (skin) which forms an interface between the external world and the internal environment. This covering epithelium is the epidermis.

- Definition:

The covering epithelia form the surface of the body and line the internal cavities and ducts as well as the hollow organs of the organism.

The covering epithelia derive from the three primordial laminae put in place at the end of the primordial morphogenesis period of the embryo.

Ectoblast	Mesoblast	Endoblast
Epidermis Epithelium of the oral cavity.....	Mesothelia and vascular endothelia	Epithelium of the digestive tract.....

Table 01: fate of the three embryonic layers

- Functions :

They have many functions:

- Protection
- Absorption, particularly in the intestine ;
- Movement of surface structures thanks to the presence of vibratory cilia;
- Air/blood exchange; urine/blood exchange, etc.
- Reception of sensory messages via apical differentiation of auditory cells, taste cells, etc.
- Renewal of epithelia by stem cells characterised by their undifferentiated state, long life span and capacity for division.

II.3. Glandular epithelia :

- Definition :

Glandular epithelia contain glandular cells which are often organised into functional units or secreting units. Glandular epithelia constitute glandular elements:

Grouped into organs: liver, salivary glands, endocrine glands.

Associated with a covering epithelium: glands of the respiratory or digestive mucosa.

Single-cell elements in a covering epithelium: caliciform cells.

Multi-cellular elements in a lining epithelium: nasal cavity.

III.MUSCLE TISSUE :

- Definition :

Muscle tissue has one physiological property, contractility, which is provided by muscle cells or myocytes known as muscle "fibres".

muscle cells or myocytes known as muscle "fibres". These cells are characterised by the presence in their cytoplasm of numerous myofibrils composed of myofilaments grouped in parallel along the long axis of the cell, There are three types of muscle tissue made up of muscle cells or myocytes:

- **Striated muscle tissue** , derived from myotomes, is generally associated with the skeleton and is made up of muscle cells (rhabdomyocytes) which show transverse striation.It contracts voluntarily.

- **Smooth muscle tissue** is made up of leiomyocytes, also of mesenchymal origin. mesenchymal origin, is located in the walls of the viscera and vessels. The smooth muscle contraction, under the control of the vegetative nervous system, is involuntary.

- **Cardiac muscle tissue** is composed of cardiomyocytes derived from mesenchyme. It is very similar to striated muscle tissue and is only found in humans in the myocardium.It is characterised by its ability to contract rhythmically and harmoniously. It is innervated by the vegetative nervous system: the rhythm of the heartbeat is determined by the activity of the sino-auricular node, but can be modified by sympathetic and parasympathetic. Tab.02.

Striated muscle tissue	Smooth muscle tissue	Cardiac muscle tissue
-Generally associated with the Skeleton. -Cell type: rhabdomyocytes. -Voluntary contraction. -	Located in the walls of viscera and vessels. -Cell type : Leiomyocytes. -Contraction is dependent on the vegetative nervous system and is involuntary.	-It is only found in only in the myocardium. -Cell type: cardiomyocytes. -It is characterised by its ability to contract rhythmically and harmoniously spontaneously.

Table 02: Types of muscle tissue

IV. CONNECTIVE AND SUPPORT TISSUES :

IV.1 Definition :

Connective tissues are filling tissues, as well as supporting tissues (supply of nutrients). They are made up of 2 parts: cells (less numerous than in epithelia) (cells = fibroblasts) and fundamental substance (a liquid with mineral salts and other elements).

IV.2 Function :

Its functions are diverse and innumerable, but they can be summed up in three essential ones: support, defence and nutrition.

IV.3. The different types of connective tissue :

IV.3.1. Cartilage :

Cartilage is part of the support tissue.

-Its consistency is hard.

-The cartilage cells are Chondrocytes.

IV.3.2. Bone:

The most differentiated tissue in man, characterised by the solid nature of its extracellular matrix.

The skeleton has three functions:

-**The mechanical function** of supporting the body and protecting the organs.

-**Metabolic function:** release or storage of mineral salts, control of phosphocalcic metabolism.

-**Haematopoietic function**, including stem cells: the haematopoietic marrow.

The main bone tissue cells: Osteocytes.

IV.3.3. Blood :

Blood is a vital fluid connective tissue which circulates continuously in the blood vessels and the heart.

This liquid is used to :

-Diffuse oxygen (O₂) and nutrients.

-Transport waste products such as carbon dioxide (CO₂) and nitrogenous waste products to disposal sites (kidneys, lungs, liver, intestines).

The bone marrow produces blood cells in a process called haematopoiesis.

Blood cells are : White blood cells, red blood cells and platelets.

IV.3.4. Adipose tissue :

Is a particular form of connective tissue

-Fat reserves.

Its main cells are Adipocytes.

V. NERVOUS TISSUE :

- Definition :

The nervous system is a complex network of nerves and nerve cells (neurons) which transmit signals and messages from the brain and spinal cord to different parts of the body. It is made up of the central nervous system and the peripheral nervous system.

V.1 The central nervous system (CNS):

Consists of the brain and spinal cord.

The brain controls most of the body's functions, including perception, movement, sensation, thought, speech and memory.

The spinal cord carries nerve signals back and forth between the brain and the nerves in the rest of the body.

V.2 The peripheral nervous system (PNS) :

Is the part of the nervous system outside the CNS. It is made up of nerves and ganglia which send signals to the CNS and receive signals from the CNS.

The PNS is made up of the somatic nervous system and the autonomic nervous system.

V.2.1. The somatic nervous system :

Directs voluntary body movements (those we control, such as walking).

V.2.2. The autonomic nervous system :

Directs the body's involuntary functions (those that the body controls on its own, such as breathing and digestion).

The autonomic nervous system is subdivided into the sympathetic nervous system and the parasympathetic nervous system.

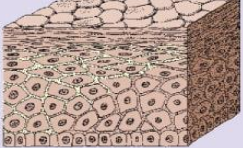


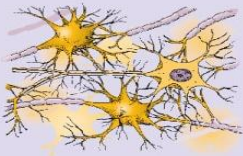
A. The sympathetic nervous system :

Prepares the body for situations that require strength and heightened perception or that arouse fear, anger, excitement or discomfort. This is known as the fight or flight response. The sympathetic nervous system increases the heart rate, speeds up breathing while making it shallower, and stimulates the metabolism.

B. The parasympathetic nervous system :

Has a soothing effect on the body. It allows the heart rate and breathing to return to normal and the metabolism to slow down in order to conserve energy.

Table 03: General presentation of the four fundamental tissues, their functions and examples of where they are located in the body.

Tissus fondamentaux	Fonction	Exemple dans l'organisme
Tissu épithélial 	Protège la surface de l'organisme Tapisse les cavités corporelles Transport, réabsorption, sécrétion, excrétion de substances	Épiderme Muqueuses Glandes
Tissu conjonctif et de soutien 	Mise en contact des structures de l'organisme, statique de l'organisme, stockage de substances, processus de transport	Cartilages, os, ligaments, tendons Tissu adipeux Sang
Tissu musculaire 	Mouvements du corps et des organes Thermogenèse	Muscles squelettiques, Cœur Parois vasculaires, Organes creux
Tissu nerveux 	Recueil, traitement, stockage et envoi des informations Commandes des fonctions de l'organisme	Cerveau, moelle spinale (MS), nerfs périphériques, organes des sens