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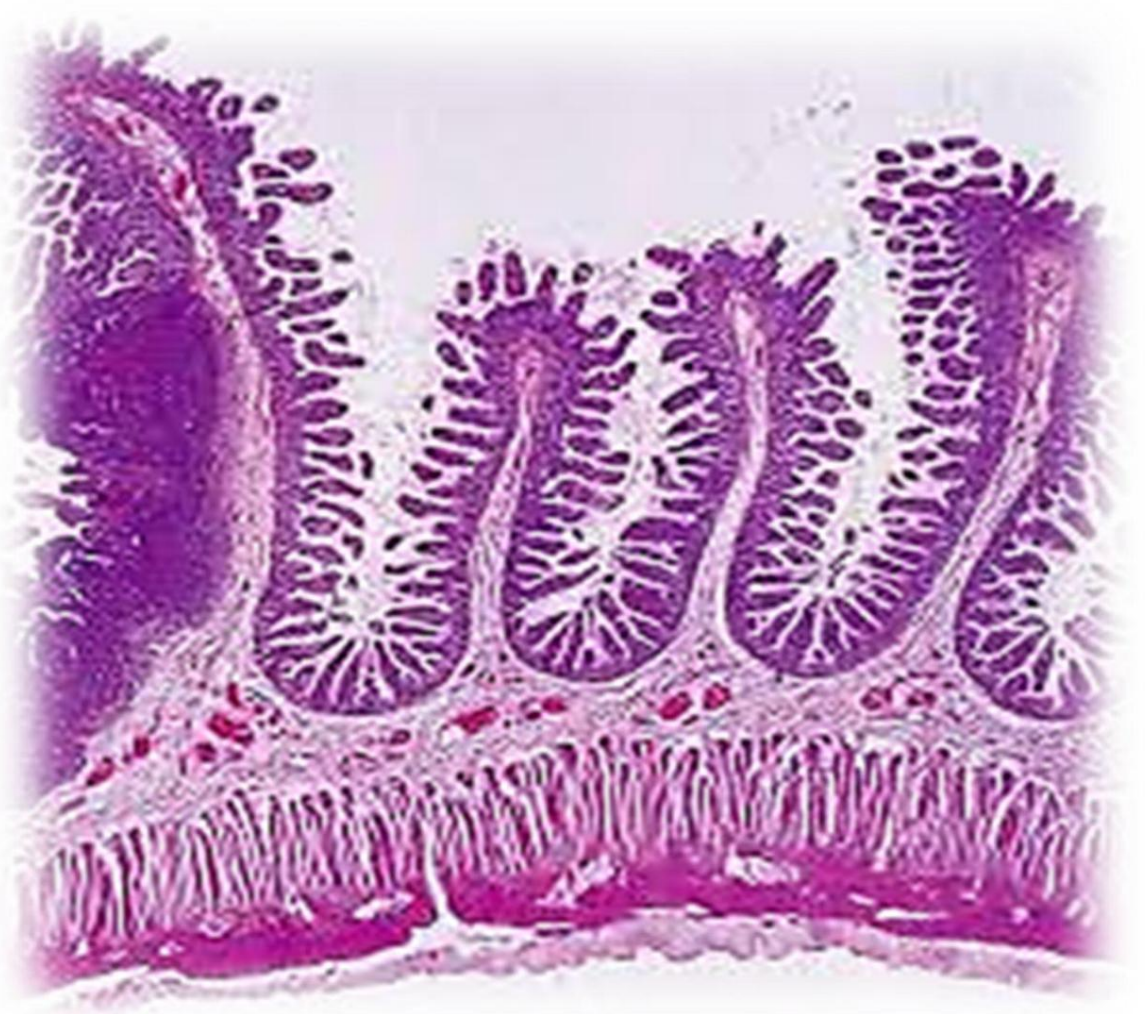

HISTOLOGIE DE L'APPAREIL DIGESTIF ET DE SES GLANDES ANNEXES

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HISTOLOGY OF THE DIGESTIVE SYSTEM AND ITS GLANDS

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INTRODUCTION

As its name suggests, the digestive system ensures digestion, that is to say the set of mechanical and secretory processes that contribute to transforming food into nutrients, into substances directly assimilated by the body. The stages of this transformation (crushing, salivation, enzymatic and microbial digestion) are adapted to the very diverse physical and biochemical characteristics of different foods: seed Dehydrated, high-fiber feed, easily digestible meat. Consequently, the organs that carry out these steps (teeth, salivary glands, stomach, large intestine) will exhibit remarkable morphological differences depending on the feeding method of each animal species.

The digestive system consists of a set of organs that work together to nourish the animal. It therefore ensures the grasping of food, its digestion, its absorption and the elimination of its indigestible components. The prehension of food in the oral cavity is ensured by The lips, tongue, and teeth. The digestive tract can be schematically represented by three reservoirs. (oral cavity, stomach, intestine) where enzymatic and bacterial digestion takes place and which are supplied by tubular passages (esophagus, small intestine, rectum). The esophagus transports the food from the oral cavity where it has undergone the grinding action of the teeth and the impregnation of saliva, all the way to the stomach (swallowing).

The small intestine is the major site of absorption of the products of digestion, while The rectum is the excretory duct for waste: feces. Depending on the diet The relative volume of these different food compartments will vary.

In carnivores, whose meals are infrequent and therefore large, the stomach has a large capacity; the small intestine is short and muscular; the large intestine is longer In particular, the cecum is poorly developed. Conversely, in herbivores In monogastric diets (small, frequent meals), the stomach has a small capacity; the small intestine is long

and finally; the large intestine is large enough to house a bacterial population capable of digest the cellulose in plants.

It consists of:

- The oral cavity: ensuring the intake, chewing and predigestion of food.
- Passage areas: the oropharynx, the esophagus and the anal canal.
-Digestive areas: the stomach, the small intestine, and the large intestine where food is digested and absorbed.
- Accessory digestive glands: the salivary glands, the liver and the pancreas.

CHAPTER 1

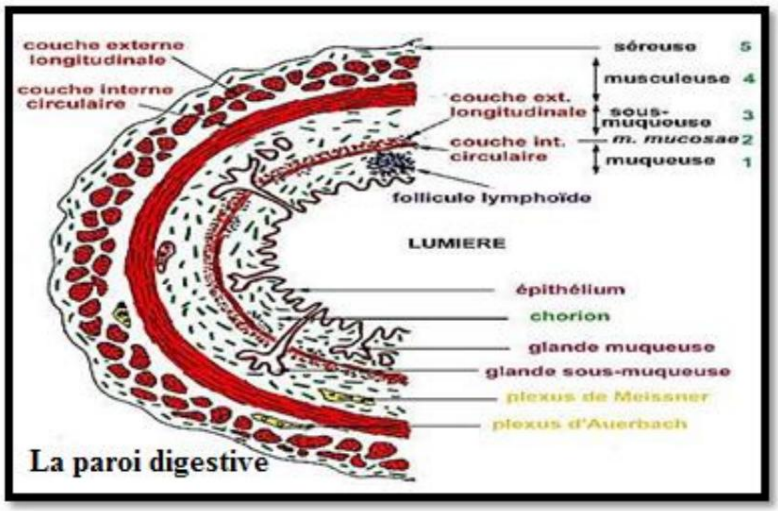
HISTOLOGY OF THE DIGESTIVE SYSTEM

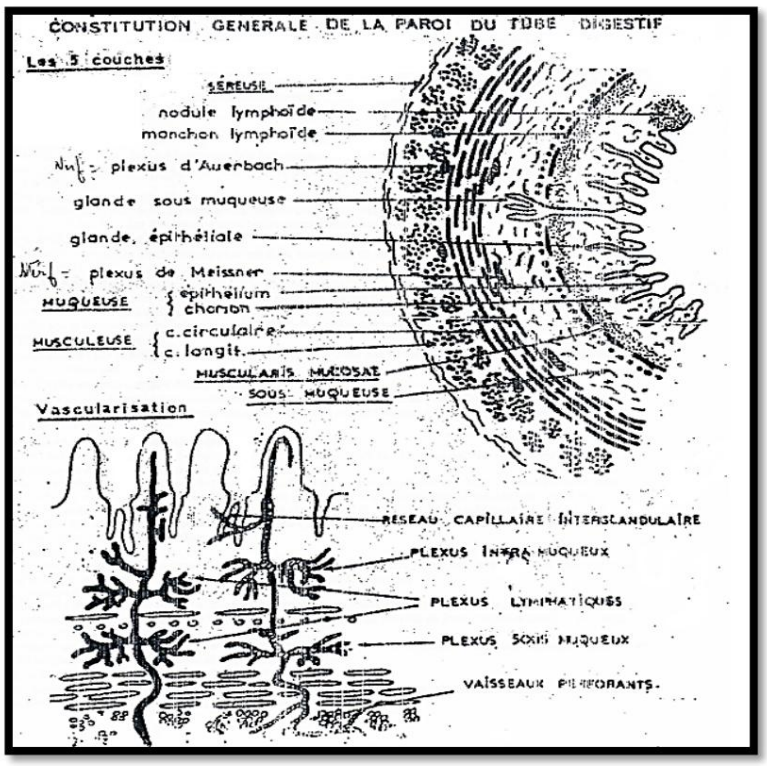
I- GENERAL INFORMATION

Anatomically, the digestive tract includes the esophagus, stomach, small intestine, and the large intestine including the rectum. Regardless of the section considered, one finds a general architecture which is identical from a histological point of view and which is explained by the existence of certain functions common to the entire digestive tract.

Thus, for example, the food bolus progresses from the exit of the pharynx to the sphincter. anal, we also find a significant muscular layer all along the wall. But Furthermore, each part has its own function, which explains why on the characters to which are common throughout the digestive tract there will be added specific modalities.

Before reviewing the various parts of the digestive tract, we will first consider its general architecture. The digestive tract consists of four concentric layers which are, starting from the lumen towards the periphery; the mucosa, the submucosa, the muscularis, The adventitia or serosa once you reach below the diaphragm. The structure histological findings in the wall of the digestive tract are present, despite some regional variations four layers or tunics arranged concentrically around the light





I.1 The digestive mucosa

It consists of a surface epithelium resting on a layer of connective tissue.
called chorion or *Lamina propria* containing glands, and of the *Muscularis mucosae*
formed of smooth muscle fibers designed to allow the folding of this mucous membrane.

I.1.1 The digestive epithelium

Its primary role is mechanical, protecting the underlying layers from contact.
with food. In the esophagus, this food still has a fairly firm consistency;
The epithelium is stratified, which gives it greater resistance. From
In the stomach, it becomes unillustrated and invaginates into the chorion to form numerous
glands responsible for gastric secretions. In the intestine, it is unicellular and
absorbent.

The lifespan of epithelial cells in the digestive mucosa is limited, among other things, by
As a result of friction from the food bolus, the cells die, flake off, and fall into the
light. Their renewal is ensured thanks to the presence of numerous mitoses located at the
level of the basal layer in the esophagus and at the level of the crypts in the stomach and
the intestine.

The epithelium of the digestive tract is covered everywhere by a layer of mucus. The latter provides lubrication, to which is added, at the level of the stomach, protection against the self-digestion of the mucosa by digestive ferments and at the duodenal level Neutralization of stomach acid. This mucus originates at four levels which vary depending on the section of the digestive tract: goblet cells scattered among the covering epithelial cells, some covering cells themselves, of crypts and glands of the chorion and finally glands of the submucosa. Another function of the The mucus acts as a sticky substance, trapping bacteria or parasites and thus preventing them from attaching to cells. epithelial.

I.1.2 The chorion or *Lamina propria*

It supports the epithelium, providing it with nutrition through the capillary network it contains. It is a reticular or loose connective tissue; it may contain glands and muscle fibers. smooth disseminated lymph nodes, lymphatic nodules. It has a supportive, nourishing, and... defense. Most of the glands of the digestive tract, of the tubular type, are located in the chorion.

I.1.3 The muscularis mucosae

It borders the outer surface of the mucous membrane along most of its length. It is composed of smooth muscle fibers whose contraction ensures certain movements specific to This mucous membrane, independently of the contractions of the rest of the wall. It is one of the factors responsible for the formation of more or less pronounced folds on the inner face of the digestive tract.

It is classically described as having an inner layer of muscle fibers. smooth muscles arranged in a circular pattern (muscle cells are oriented so that their long axis (either perpendicular to that of the digestive cavity), and an external layer available longitudinal (smooth muscle cells arranged so that their long axis is parallel to that of the digestive cavity). The muscularis mucosa may be deficient in certain areas.

I.2 The submucosa

It is composed of loose connective tissue rich in elastic fibers containing a plexus of small blood vessels called Heller's plexus, it also includes many lymphatic vessels and a Meissner nerve plexus or "submucosal plexus of Meissner.

The submucosa may in places contain mucous glands that release their contained within the lumen thanks to excretory ducts passing through the mucous membrane. This is the case in level of the esophagus and duodenum.

I.3 The muscular

It consists of two thick layers of smooth muscle cells, the inner one to Circular arrangement and external longitudinal arrangement. Added to this is the largest part of the stomach, an internal oblique layer.

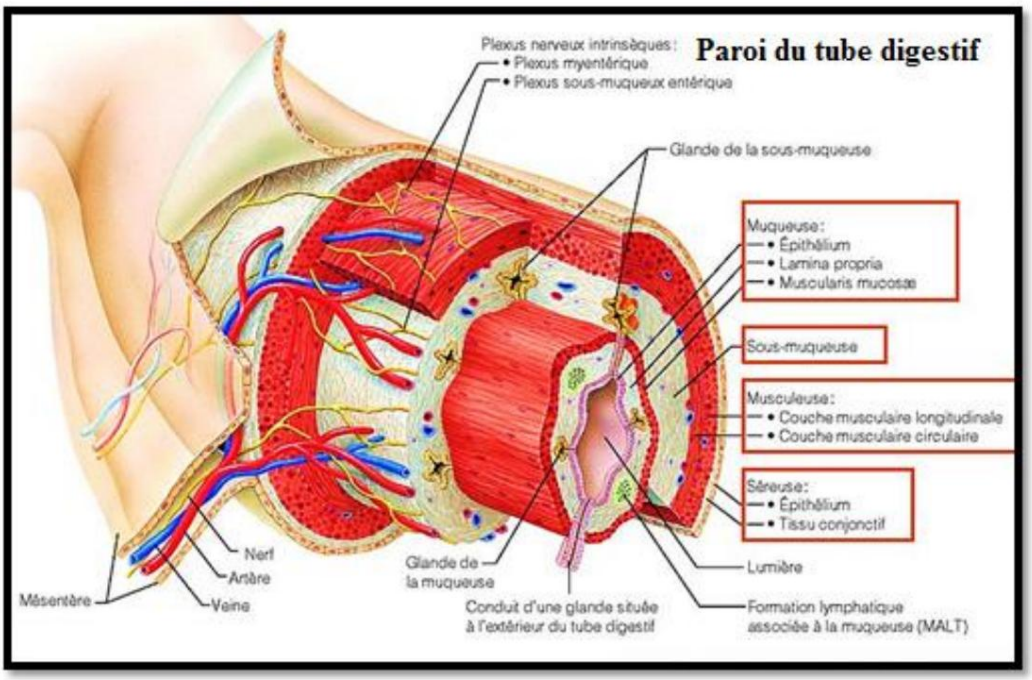
A nerve plexus, known as Auerbach's plexus, located between the inner and outer layers, controls the contractions of this muscle.

Its main functions are:

- Move the food bolus from the pharynx to the rectum.
- At the level of the stomach, it ensures a good part of the mixing of the elements which mix with digestive ferments in preparation with muscle nutrients mucous membrane.
- In the small intestine, this tunic ensures segmentation movements, and at the level of the large intestine, movements known as haustra.
- To exhibit a level of muscle tone partly responsible for maintaining a certain form of the organ.
- Apart from any stimulation related to diet; the muscles of the muscular can contract spontaneously.
- Localized thickenings of the inner layer form sphincters (junction pharynx-esophagus-pylorus, ileocecal valve etc…).

I.4 Adventitious or serous

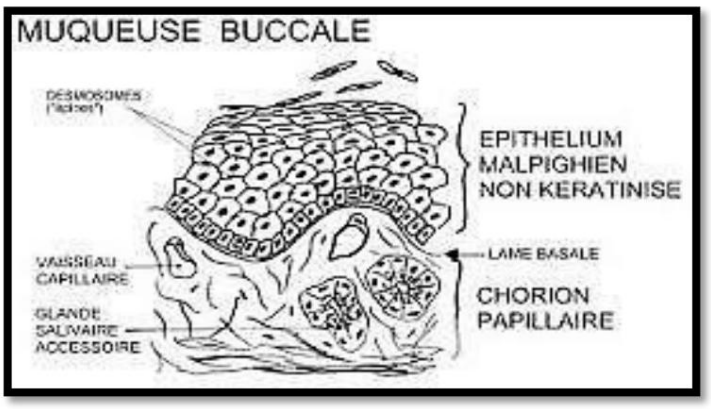
It is the outermost layer, composed of loose connective tissue frequently containing tissue adipose tissue and is lined with mesothelium continuous with the peritoneum at the level of The intestine is found in the territory of the digestive tract located below the diaphragm.



II. HISTOLOGY OF THE ORAL CAVITY

The oral mucosa is covered by a stratified squamous epithelium, resting on a richly vascularized papillary chorion containing small salivary glands disseminated, mucous or seromucous.

In many animals, it is heavily pigmented and keratinization is accentuated. especially in the region of the top of the tongue and palate.



II.1 The lips

A lip consists of 4 layers:

-externally, the skin, which varies with the animal species in the lip region

superior.

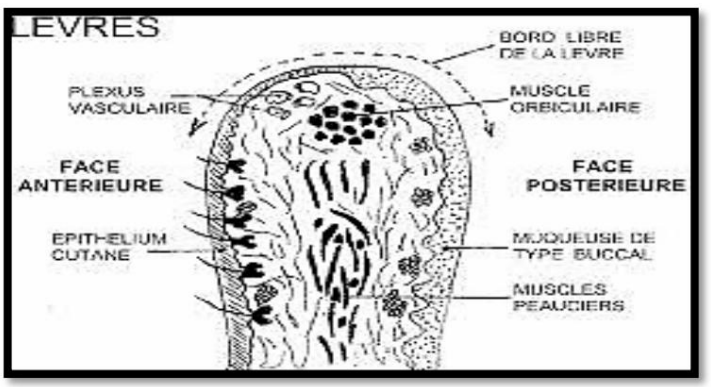
-a transversely stratified orbicularis oculi muscle.

-a thin glandular layer (serous type labial glands).

-an epidermal-type labial mucosa with a keratinized squamous epithelium which

present in ruminants, large conical papillae at the corners of the lips serve

to the transport of food.



II.2 The gums

They are covered by the oral mucosa, directly joined to the periosteum of the jaws, without

submucosal tissue. The chorion has papillae that penetrate deeply into

the thickness of the epithelium. The blood vessels are located along the axis of these papillae.

II.3 The cheeks

Subjected to stretching movements during chewing, they have submucosal tissue
connective tissue rich in elastic fibers and contains glands between the skin and the muscular layer
mucous type.

II.4 The palace

It is a partition that separates the mouth from the nasal cavity, and which includes, on the mouth side:
The oral mucosa and, on the side of the nasal cavities: the nasal mucosa. In the part
Anteriorly, the palate consists of a bony support, and in the upper and lateral part of the
pharynx muscles.
The palate is covered with a mucous membrane with a highly keratinized epithelium.

In the mucous membrane, there are glands and veins running transversely. In the
In ruminants, the mucous membrane is equipped with papillae whose conical shape is visible to the naked eye.

II.5 The language

The tongue is a musculoskeletal organ formed by a striated muscle whose bundles of
cells ²ézaaés are oriented perpendicularly to each other (longitudinally,
transversely and vertically). And covered by a buccal-type mucosa which on its
The upper and anterior surfaces show differentiations; the papillae give it its appearance.
rough. The epithelium is multi-layered, squamous and keratinized.
There are 4 types of taste buds:

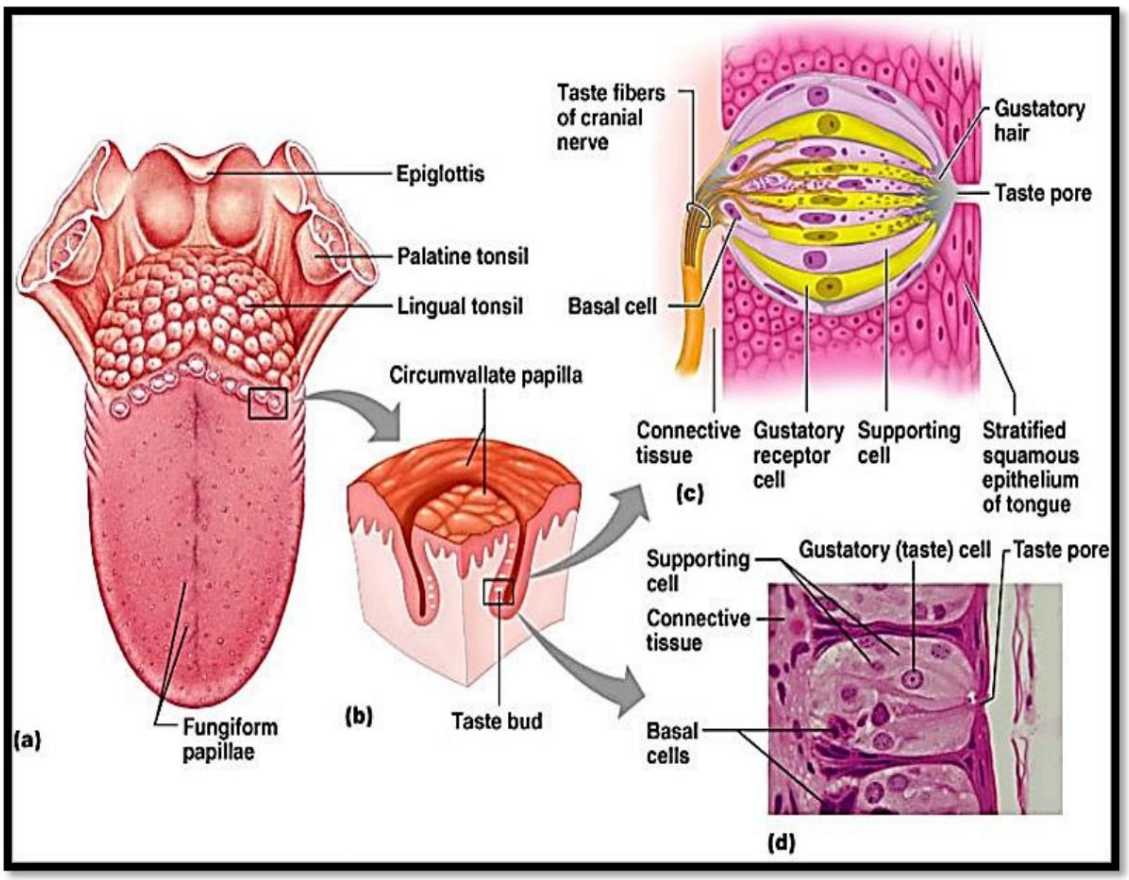
II.5.1 Filiform papillae : distributed over the entire dorsal surface of the tongue (more
precisely the anterior two-thirds of the tongue parallel to the two branches of the V
lingual. The posterior third, corresponding to the location of the lingual tonsil, is
Lacking papillae, they are formed from a single or doubled connective tissue core covered by
a multi-layered squamous epithelium that is desquamating and slightly keratinized.
In horses, they are relatively small; in ruminants, they are quite large and
heavily keratinized (rough appearance of the tongue), in carnivores, they are the most
Large, in goats, they are the most numerous. They can bear buds.
taste.

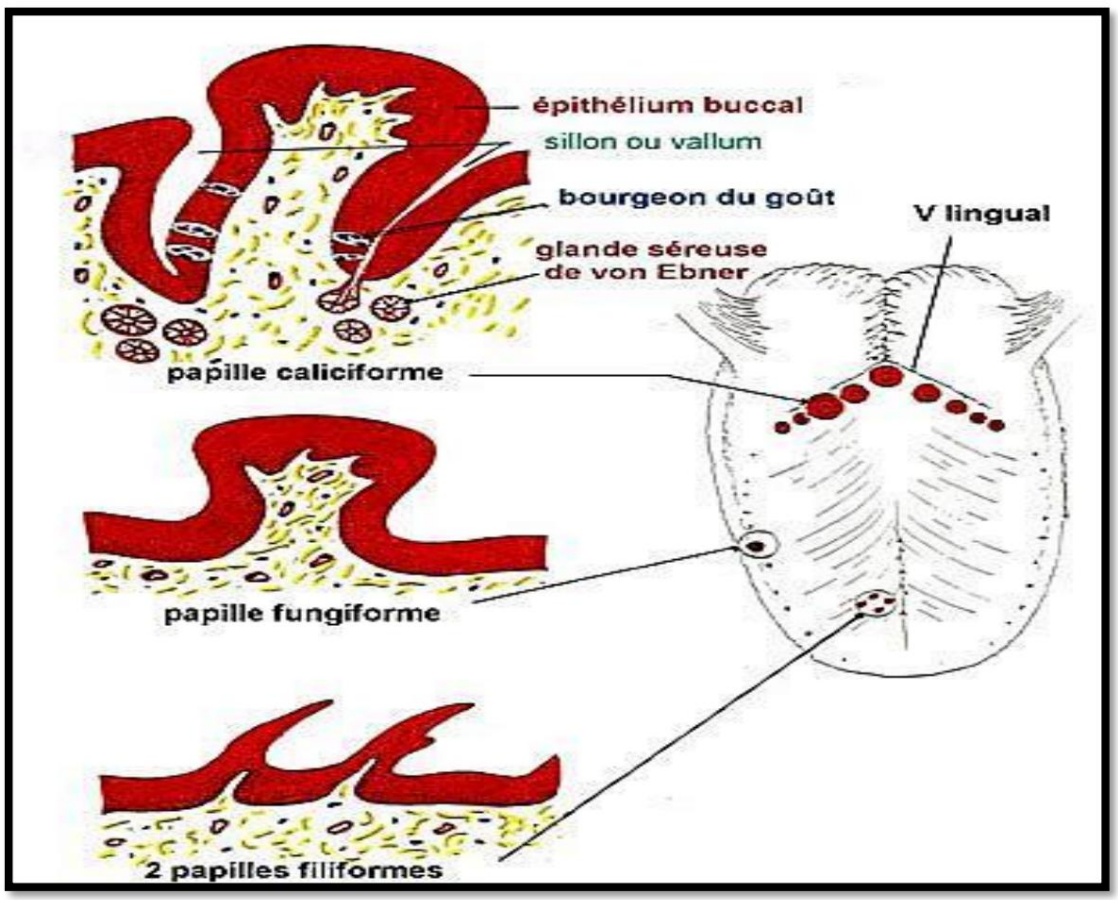
II.5.2 Fungiform papillae: These are much less numerous. They are arranged between the filiform papillae, and mainly on the edges and at the tip of the tongue, rounded in shape and in carnivores, they are the largest, in the goat; They are the most numerous.

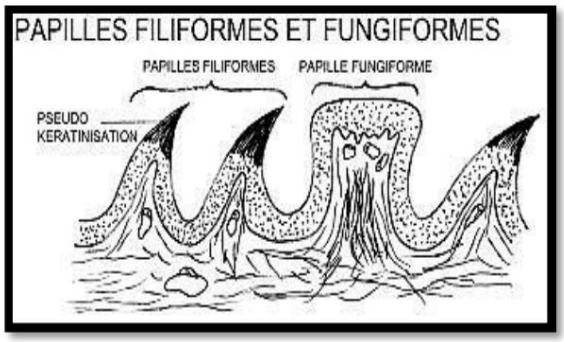
II.5.3 Circumvallate papillae : These are the largest and the least numerous, arranged at the back of the tongue, forming an open, anteriorly facing lingual V They are cylindrical in shape, flattened, and are embedded in the mucous membrane delimiting a circular groove or vallum, at the bottom of which the excretory ducts of the Von Ebner's salivary glands. These glands are contained within the chorion and are covered by a buccal epithelium which contains numerous taste buds located on the inner edges of the vallum.

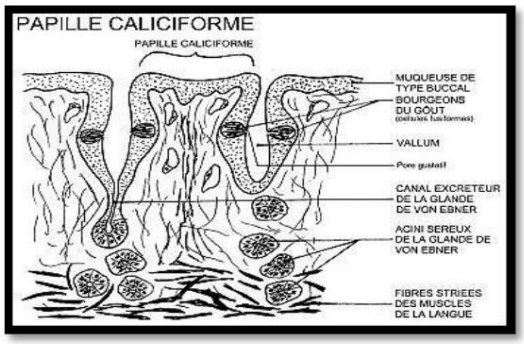
II.5.4 Foliate papillae: These are absent in ruminants; they are found only in carnivores and especially in rabbits where they are very well developed in the horse they form a papillary mass, they open at the same location as the circumvallate papillae appear as coiled serous glands.

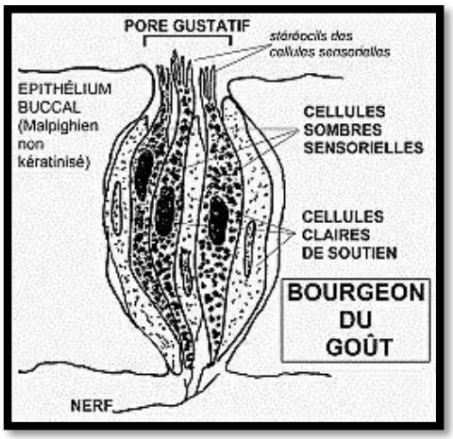
Apart from Ebner's serous gustatory glands, there are sero- glands all over the tongue mucous membranes and at the base of the tongue mucous glands whose glandular body is located in intramuscular connective or adipose tissue.


Epiglottis
Palatine tonsil
Lingual tonsil
Circumvallate papilla
Fungiform papillae
(a)
(b)
Taste bud
Taste fibers of cranial nerve
Gustatory hair
Taste pore
Basal cell
Connective tissue
Gustatory receptor cell
Supporting cell
Stratified squamous epithelium of tongue
(c)
Supporting cell
Gustatory (taste) cell
Taste pore
Connective tissue
Basal cells
(d)


épithélium buccal
sillon ou vallum
bourgeon du goût
glande séreuse de von Ebner
papille caliciforme
papille fungiforme
2 papilles filiformes
V lingual







- **Function of language**

Through its mobility, the tongue plays a mechanical role during chewing and is involved in the
In addition to phonation, it also performs a neurosensory function in taste thanks to the
taste buds, and a defense function through the presence of the lingual amygdala.

II.6 Teeth

These are very hard organs implanted on the alveolar edge of the maxilla and the
The mandible consists of three parts: the root, the crown, and the neck.

The tooth is made up of two fundamental substances:

- The hard substance:

- Dentin – ivory,
- Email,
- Cement

- The soft substance:

- Dental pulp,
- Periodontal,
- Alveolodental ligament.

From the inside out we observe: dental pulp, ivory, enamel, and cementum.

II.6.1 Dental Pulp

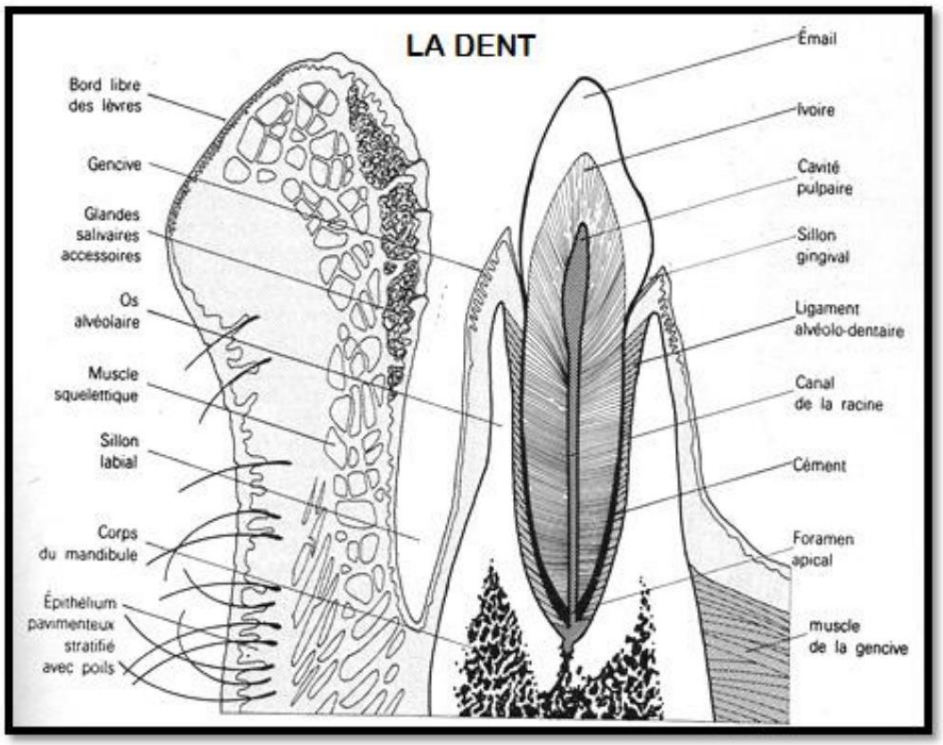
Composed of connective tissue containing blood vessels and nerves.

It comprises a central part containing fine collagen fibers, fibroblasts, and macrophages.

And a peripheral part where odontoblasts (dentin-producing cells) are located.

The tooth is vascularized by the dental artery, which penetrates the pulp to resolve in a very rich capillary network at the level of the peripheral zone.

Sensory innervation is provided by myelinated and unmyelinated fibers that reach the peripheral part of the pulp to form a marginal periodontoblastic plexus.



II.6.2 Dentine or ivory

It constitutes the true skeleton of the tooth, a structure similar to that of bone but acellular because The odontoblasts that produce it are located in the pulp. These cells emit cytoplasmic extensions that run across the surface of ivory; these are the canaliculi. dental or tomes fibers.

II.6.3 Email

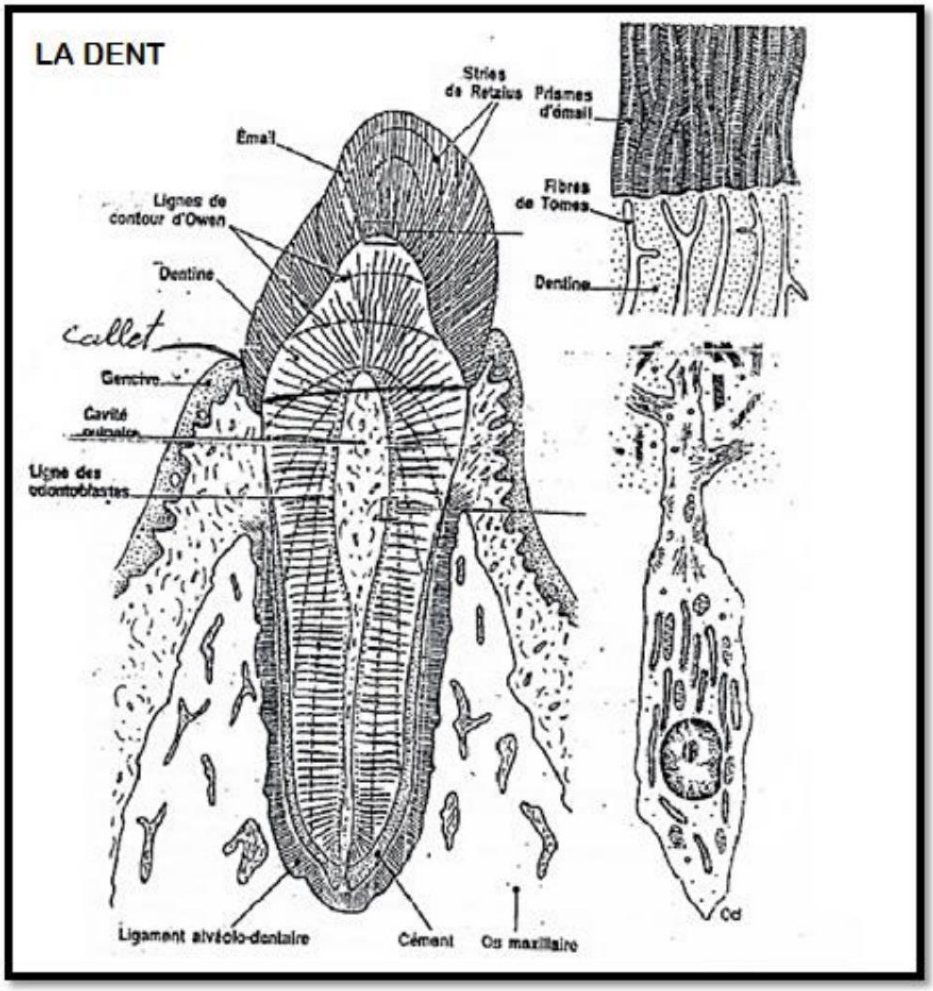
It is an extremely hard, translucent tissue (the hardest in the body), of which the Mineralization reaches 96% of calcium salts secreted by the adamantoblasts during life intrauterine. Enamel has a structure made of thousands of hexagonal prisms. sinuous contour deep down but become perpendicular to the surface of the tooth (lamellar aspect).

II.6.4 Cement

Covers the dentin at the root. Structure similar to bone but differs from it by a non-lamellar organization and the existence of two distinct layers: an inner or cementum acellular (a few microns thick), and a thicker outer or osteocemental layer containing cementocytes.

II.6.5 Alveolodental ligament

Occupies the space between the cementum and the alveolar bone; composed of collagen fibers horizontal and longitudinal orientations.



II.7 The pharynx

This is a crossroads of the aerodigestive tract which comprises 3 sections:

The nasopharynx (located above the soft palate), the oropharynx, and the laryngopharynx.

The mucosa is of the respiratory type with ciliated and goblet cells in the part

nasal, whereas it is of the oral type in other regions of the pharynx.

The submucosa contains numerous lymphoid follicles and a few glands.

pure mucous membranes.

The muscularis is made of striated muscle tissue arranged in two layers: internal and longitudinal.

and external oblique.

III. HISTOLOGY OF THE ESOPHAGUS

This is the initial part of the digestive tract; it begins at the lower part of the pharynx and opens in the stomach, at the level of the cardia after passing through the diaphragm.
It comprises 04 segments: cervical, thoracic, diaphragmatic, and abdominal.

In cross-section, the lumen of the esophagus has the appearance of a flattened slit from front to back. rear and more widely open at its lower part.
Around this light are arranged the four characteristic layers of the digestive tract:

III.1 The mucous membrane

It has an epithelium identical to that of the oral cavity, i.e., squamous.
This non-keratinized stratified layer rests on a chorion made of loose connective tissue. containing numerous lymphocytes, either isolated or grouped in follicles.
In its lower part are distributed tubuloalveolar glands, composed, purely mucous membranes or cardiac glands.
The muscularis mucosa is absent in the upper quarter of the esophagus and only appears in the In its middle and lower parts, it is made up of bundles of smooth muscle cells. longitudinal.

III.2 The submucosa

It is made of loose connective tissue rich in elastic fibers and contains acinar glands. compound, seromucous (esophageal glands) which are distributed along the entire length of the esophagus, whose excretory ducts pass through the mucosa to open into in the light.

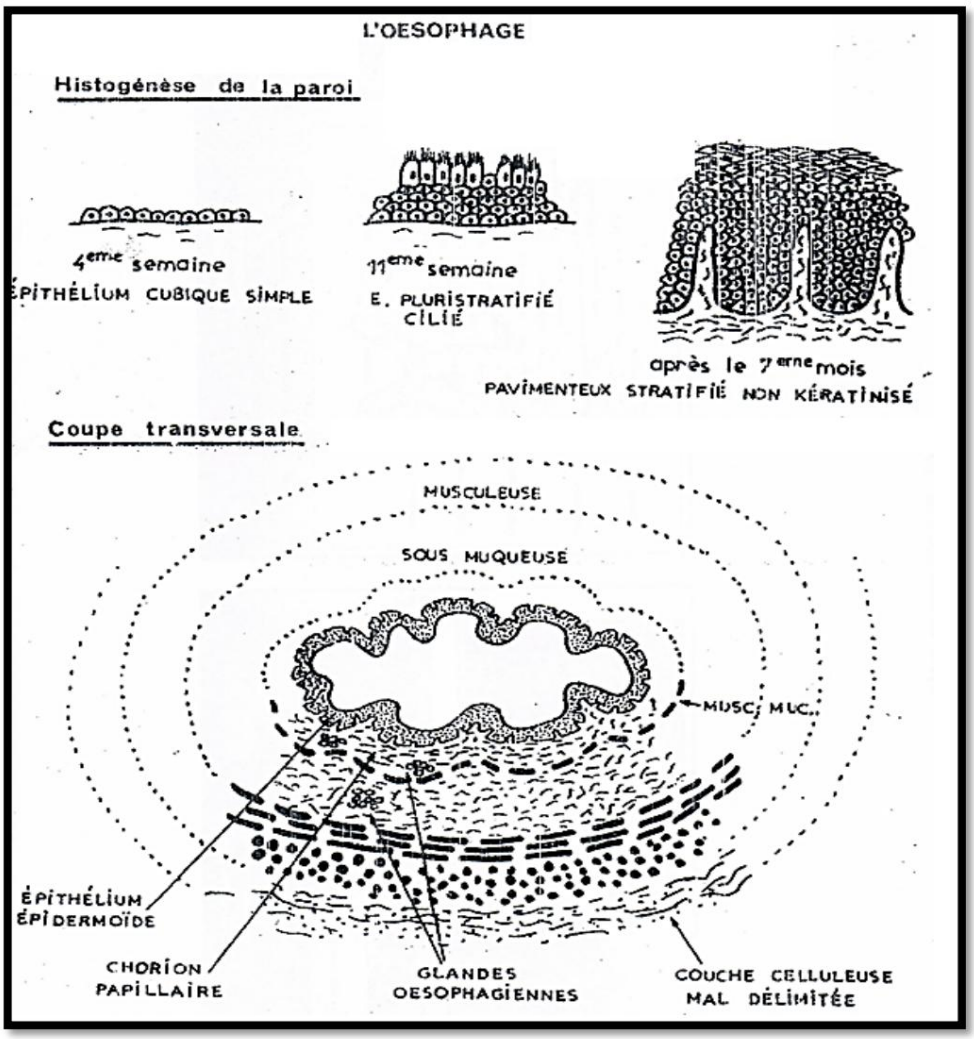
III.3 The muscular

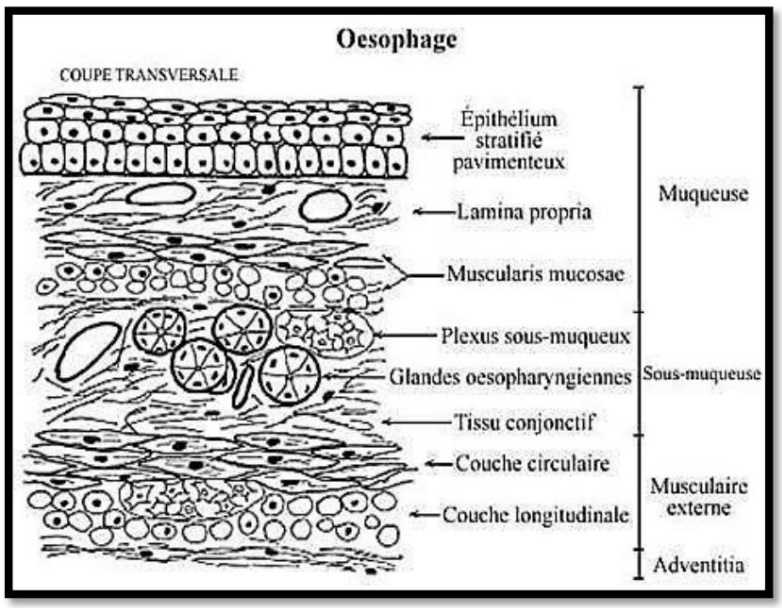
Composed of two layers: an inner circular layer and an outer longitudinal layer. In dogs and... In ruminants, it consists of transversely striated fibers, and in horses and cats, there is smooth muscle fibers in the distal 1/3 of the esophagus.

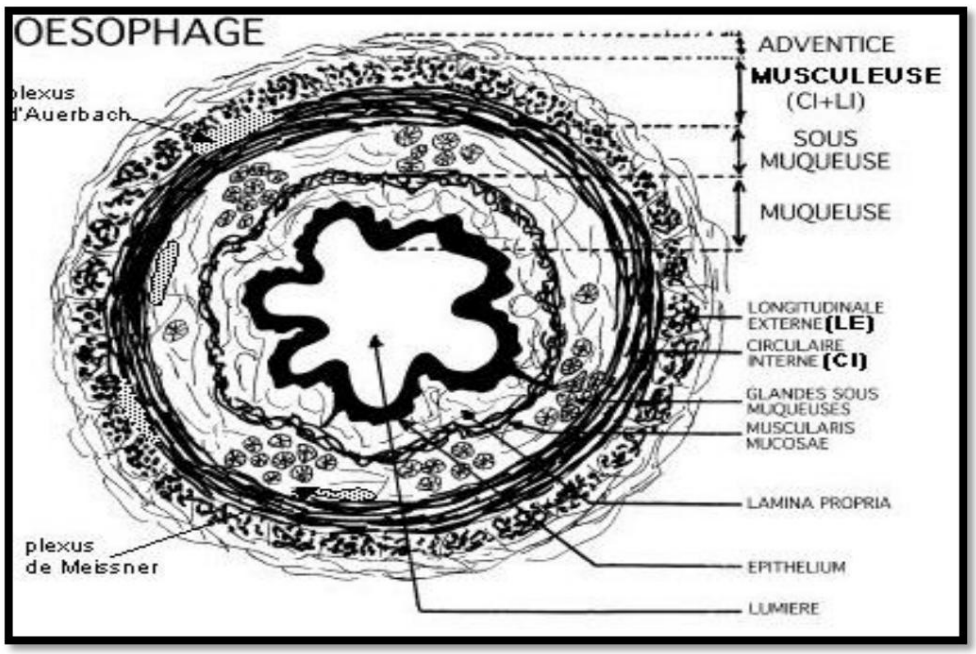
III.4 The serous membrane (adventitious plant)

It is a loose connective tissue in the neck and chest area; it is a

It is a serous membrane infiltrated with fat and traversed by blood vessels and nerves. traversed by accessory muscles (crico-esophageal, pleuro- and broncho-esophageal).







- **Role of the esophagus**

It allows for the rapid progression of the food bolus thanks to two complementary factors: the gravity for liquids and peristaltic contractions of the esophageal musculature.

IV HISTOLOGY OF THE STOMACH

This is the most dilated segment of the digestive tract, at which point the food bolus is accumulated and chemically transformed before being eliminated into the intestine.

The stomach wall is composed of the 04 tunics characteristic of the digestive tract;

A stomach mucosa with a submucosa, a muscularis propria, and an envelope serous.

The stomach lining itself is characterized by stomach glands, which

It presents itself in 03 spaces which are designated according to their position as glands of the cardia, glands of the fundus, pyloric glands.

Only in humans and carnivores is the entire stomach lined.

of the mucous membrane itself (simple stomach).

Ruminants have a multi-compartment compound stomach, which consists of three forestomachs (rumen, reticulum, and omasum) shaped like sacs and lacking glands; and a real stomach equipped with glands (the abomasum).

The fore-stomachs of ruminants

- ÿ The rumen or paunch;
- ÿ The network or reticulum;
- ÿ The leaflet or omasum.

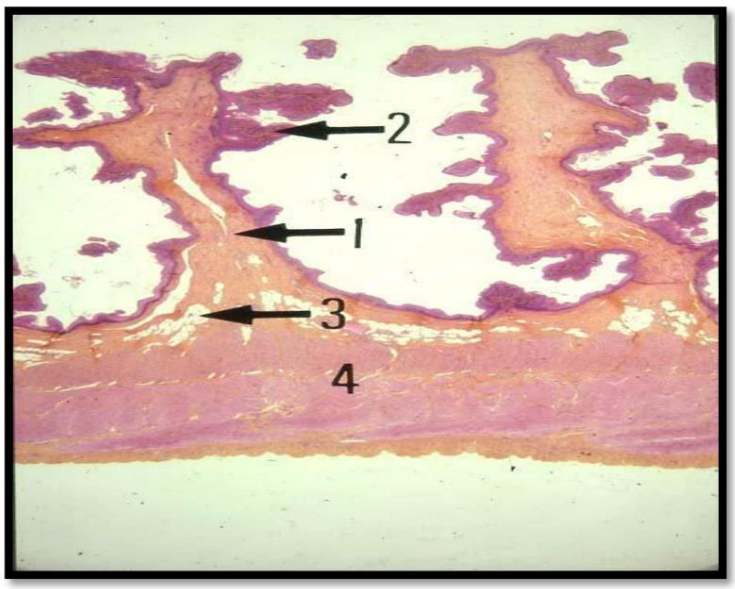
IV.1 Paunch or rumen

Its mucous membrane forms the villi of the rumen, or papillae, which can reach a height of 1 cm. linguiform or conical and possessing a papillary body. They are delimited by a keratinized squamous epithelium resting on a fairly dense chorion. The

The musculature is formed of two to three layers; the inner layers are circular and the outer layer is

It is longitudinal and thick at the papillae. The serosa contains connective tissue.

It is loose and contains a lot of fatty tissue. It houses large blood vessels and nerves.



Tripe : 1- primary papillae, 2- secondary papillae, 3- adipose cells, 4- muscularis

IV.2 The network

Its mucous membrane forms ridges of varying heights, which join together;

They constitute a cellular network, the hexagonal-shaped alveoli of the cap. In their

At depth, secondary ridges are formed, as well as successive tertiary ridges which

constitute compartments. Their internal structure is analogous to that of the rumen (epithelium)

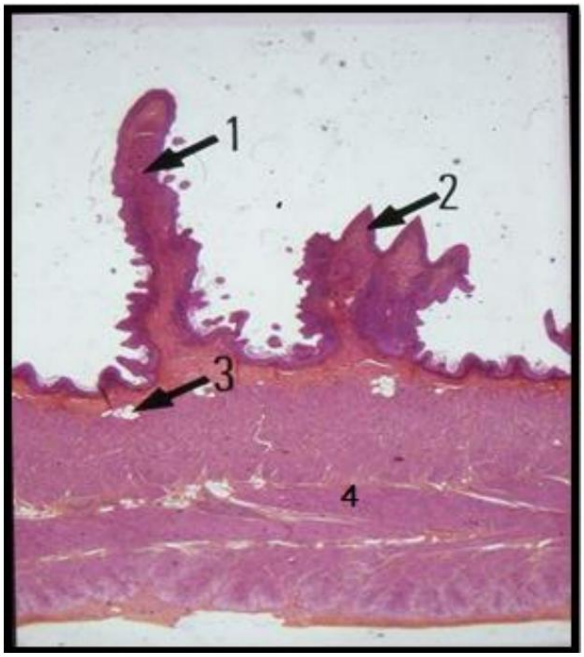
Malpighian covering a connective tissue axis).

The ridges have smooth muscle fibers arranged in a circular pattern at their apex, of which

Contraction allows the alveoli to close; these bundles are related to the

The muscularis mucosae. The muscularis is strong, its two layers (inner and outer)

cross with a straight nail.



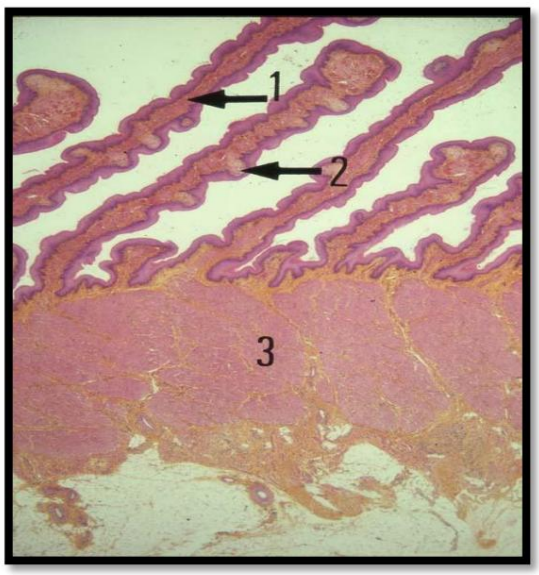
Cap or reticulum : 1- primary papillae, 2- secondary papillae, 3- fat cells, 4- muscle.

IV.3 Sheet

Its cutaneous mucosa forms longitudinally arranged, blade-like expansions. (primary, secondary, tertiary and quaternary plates).

The muscle sheath itself consists of a thin outer layer of fibers longitudinal and a thicker layer of circular fibers.

The serous tunic manifests itself in its horned appearance.

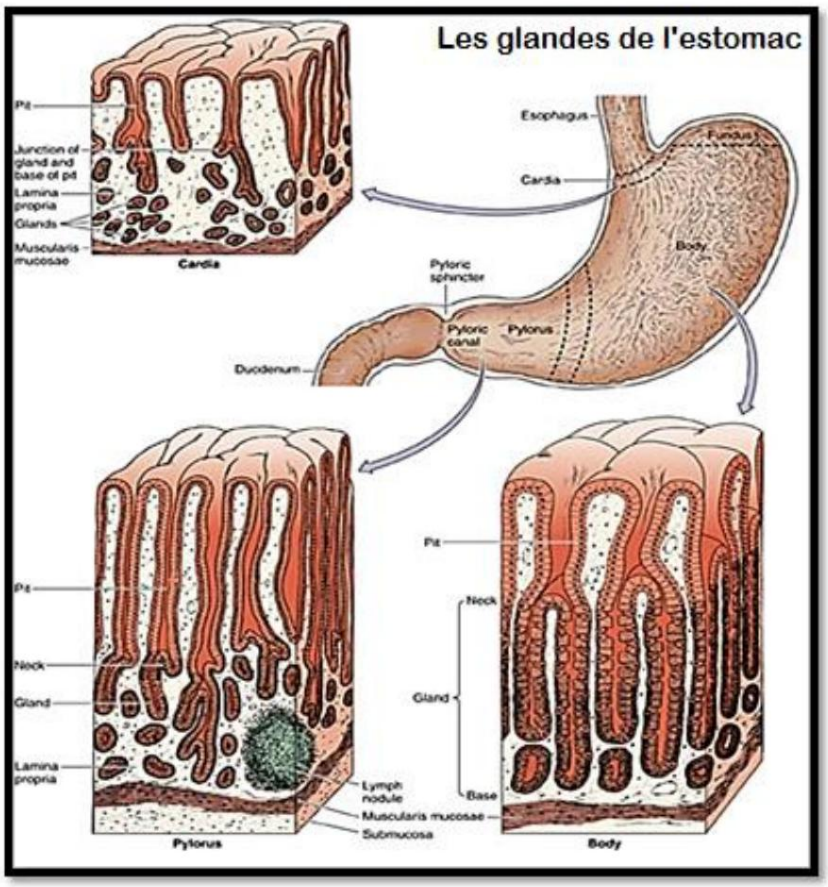


Leaflet : 1- primary papillae, 2- secondary papillae, 3- muscular layer.

IV.4 HISTOLOGY OF THE ABORTIUM OR STOMACH PROPER

It corresponds to the abomasum of ruminants, at the level of which the food bolus is chemically transformed before being eliminated into the intestine. Located just below the diaphragm, In the left hypochondrium and epigastric fossa, it presents two distinct parts the first, vertically descending, including the large tubercle, located above the opening of the esophagus, and the body of the stomach, a sort of cylinder narrowing downwards and the base of which is formed by the small tubercle, the second is horizontal, located at the bottom of the organ, directed to the right and ending in the antrum and the pyloric canal, a canal at the level to which the stomach is attached to the duodenum.

Arterial vascularization is provided by branches of the celiac trunk, and the veins are Drained into the portal vein, the extrinsic innervation originates from the vagus nerves and large and friendly, it splits into three stalks destined for the small tubercle and the Intrinsic innervation is provided by the duodeno-pyloric and subpyloric regions. Meisner and Auerbach plexus.



ÿ **Histological structure:** The gastric wall is formed by four tunics

Characteristics of the digestive tract: mucosa, submucosa, muscularis and serosa, with

However, there are significant locoregional variations.

IV.4.1 Mucous Membrane

Upon opening the stomach, the gastric cavity appears to be traversed by deep folds, especially at the
At the body level, these folds disappear when the organ is distended. On a smaller scale
The surface of the mucous membrane has fine grooves that delimit areas of 3 to 4 mm
diameter, persistent regardless of the state of fullness. These grooves are the expression
regular invagination of the mucosal epithelium which forms crypts protecting the
glands.

The gastric mucosa is characterized by the presence of a lining epithelium
simple prismatic with a closed mucous pole and glands that will have a different appearance
depending on the region.

The superficial gastric epithelium consists of a single layer and extends over the entire
surface of the gastric mucosa and inside the crypts. It is made up of cells
Polyhedral, taller than wide, possessing an ovoid nucleus located in the basal third.
The apical pole is occupied by mucus granules, bounded by a membrane that does not fuse
that rarely between themselves or with the plasma membrane.

Depending on the type of gland, three varieties of gastric mucosa are distinguished: fundic,
pyloric, and cardiac.

IV.4.1.1 the gastric fundic mucosa

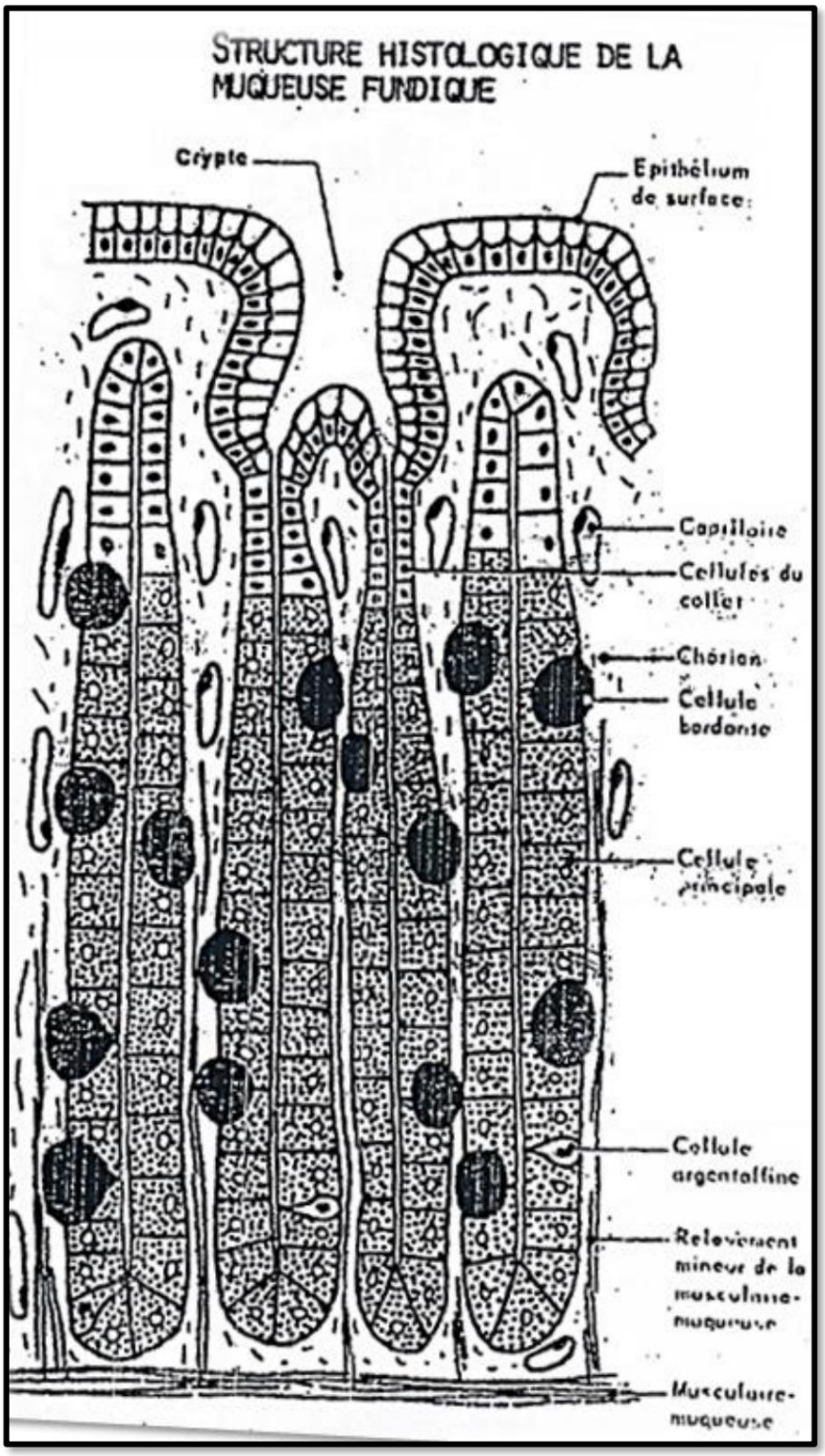
It is characteristic of the fundus (large tuberosity) and body of the stomach region.
Approximately 0.8 mm thick, it forms crypts covered by the surface epithelium, at
at the base of which the fundic glands open. These are straight tubular glands.
comprising a junction zone with the superficial epithelium, a neck, a body and a base.
These glands consist of 4 cell types resting on a basement membrane

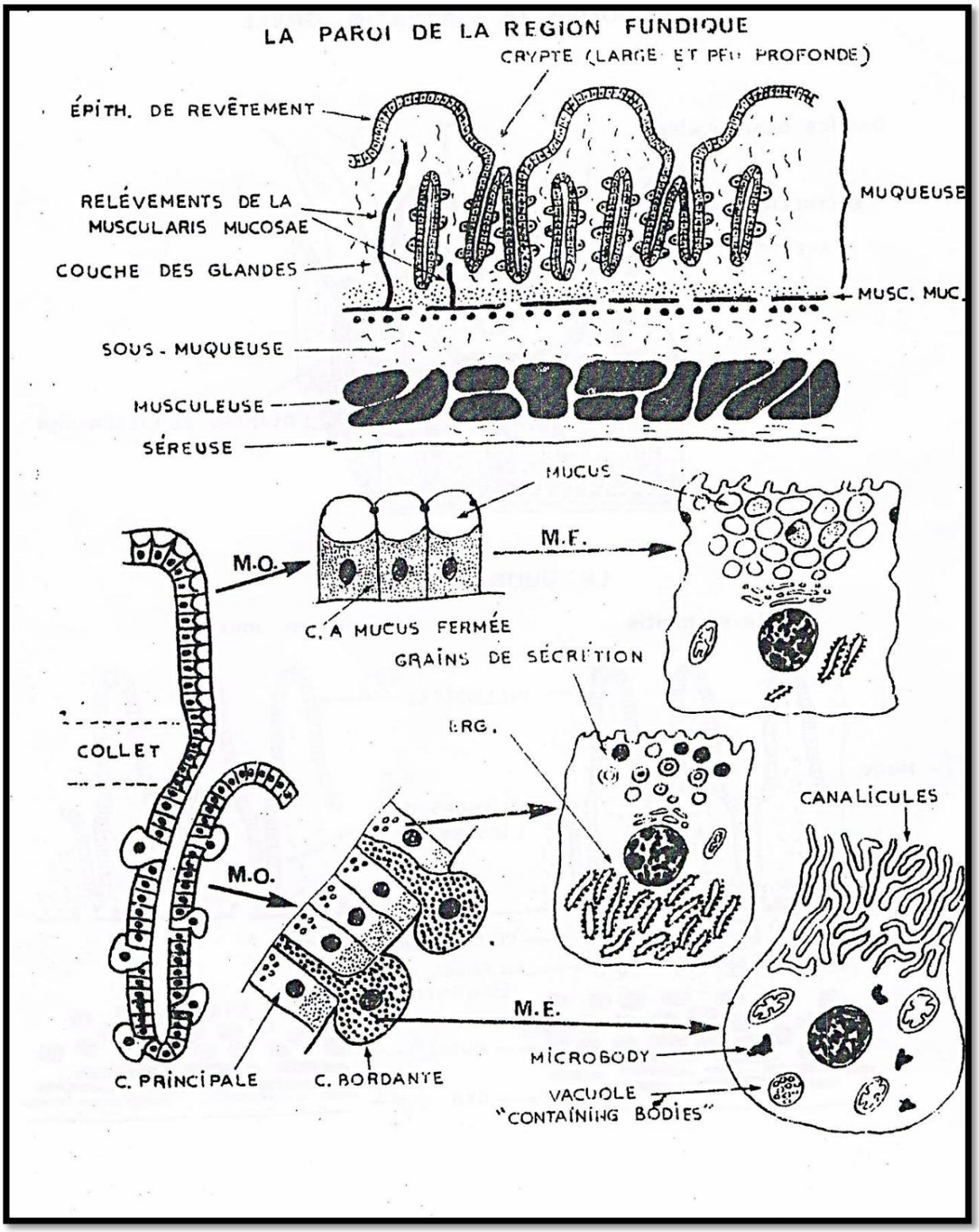
a- The small mucoid cells of the neck contain, in their cytoplasm, Mucopolysaccharides, carboxyl acids. Exhibiting a heterogeneous structure under the microscope. electronics as well as pepsinogen granules, a precursor of pepsin.

b- The chief cells constitute the majority of the cells in the body of the gland. They secrete large quantities of pepsinogen and possess all the characteristics of protein-secreting cells with a rounded nucleus, a very basal granular reticulum developed, a supranuclear Golgi apparatus and apical secretory granules.

c- Parietal cells (bordering cells or oxyntic cells) : these are large oval cells that are located in an eccentric position relative to the axis of the gland, and which communicate with the light through a kind of isthmus interposed between the cells main ones. At this level, the plasma membrane invaginates to form a channel intracellular, which will resolve into an extremely complex network of canaliculi, the The cell wall is covered with microvilli. This network is doubled inside by the smooth reticulum. the rest of the cell contains the usual organelles with a very high richness in Mitochondria. These cells are responsible for the secretion of hydrochloric acid and of intrinsic factor.

d- Endocrine cells, also called argentaffin cells: due to their properties reducing silver salts represents one element of the vast diffuse endocrine system of The digestive tract is composed of isolated cells. Only biochemical and cytochemical methods can analyze it. have allowed us to identify the exact secretory nature of these cells. At the level of the glands Fundic cells contain enterochromaffin cells, a large number of cells enterochromaffin-like cells, gastrointestinal cells, some secretin-secreting cells, and finally enteroglucagon cells, due to their similarity to islet cells of Langerhans of the pancreas.


STRUCTURE HISTOLOGIQUE DE LA MUQUEUSE FUNDIQUE
Crypte
Epithélium de surface
Capillaire
Cellules du collet
Chorion
Cellule bordante
Cellule principale
Cellule argentaffine
Relevement mineur de la musculaire-muqueuse
Musculaire-muqueuse


LA PAROI DE LA REGION FUNDIQUE
CRYPTE (LARGE ET PEU PROFONDE)
ÉPITH. DE REVÊTEMENT
RELÉVEMENTS DE LA MUSCULARIS MUCOSAE
COUCHE DES GLANDES
MUQUEUSE
MUSC. MUC.
SOUS-MUQUEUSE
MUSCULEUSE
SÉREUSE
MUCUS
M.O.
M.F.
C. A MUCUS FERMÉE
GRAINS DE SÉCRÉTION
COLLET
ERG.
CANALICULES
M.O.
M.E.
MICROBODY
VACUOLE "CONTAINING BODIES"
C. PRINCIPALE
C. BORDANTE

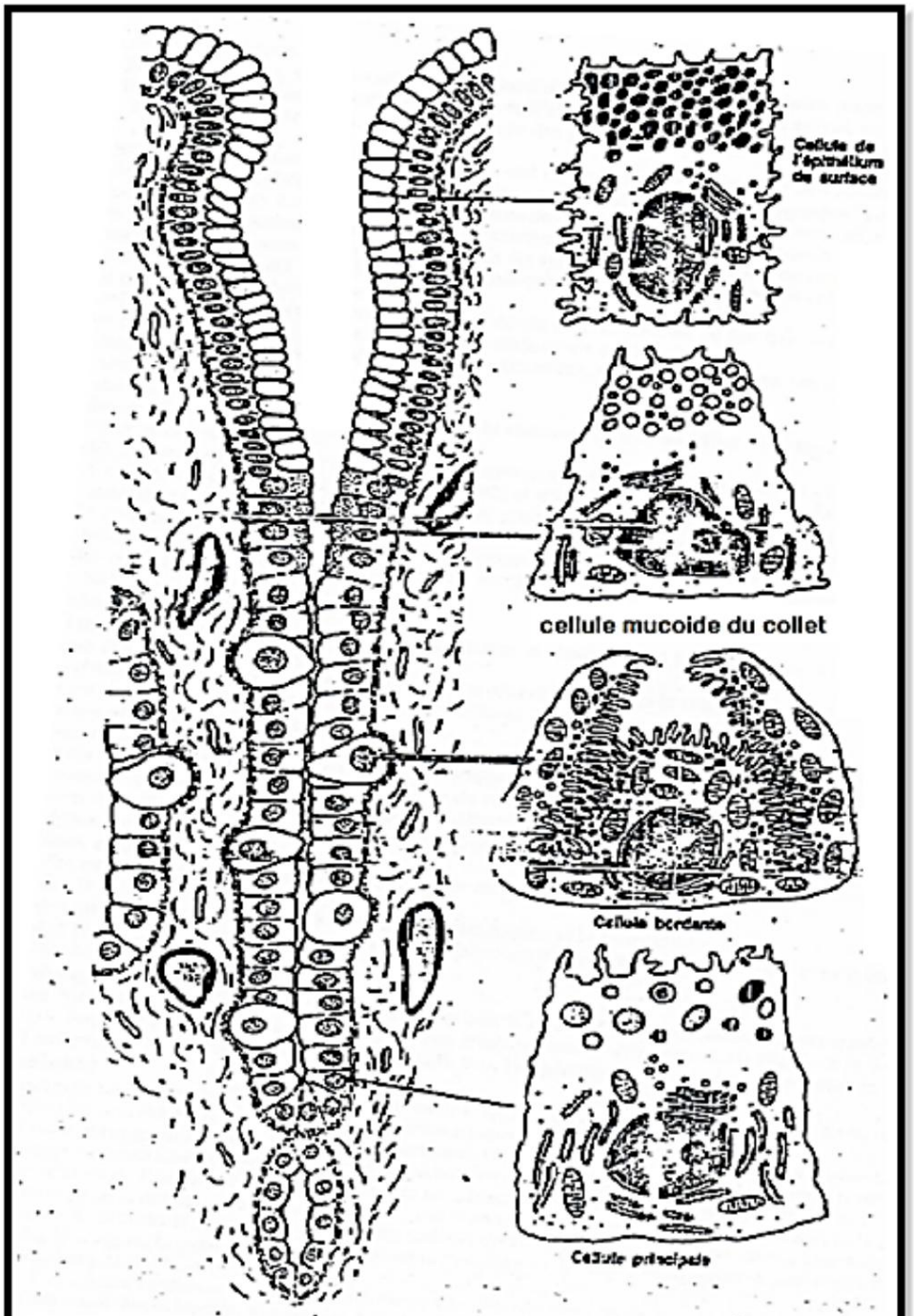
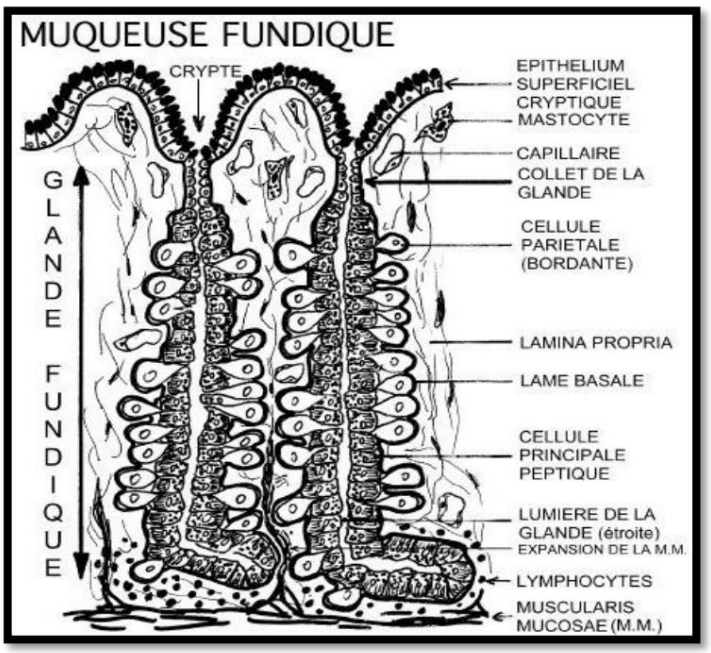


Schéma de l'ultrastructure des cellules superficielles gastriques et de trois des types cellulaires rencontrés dans les glandes fundiques (GF), avec leur localisation.

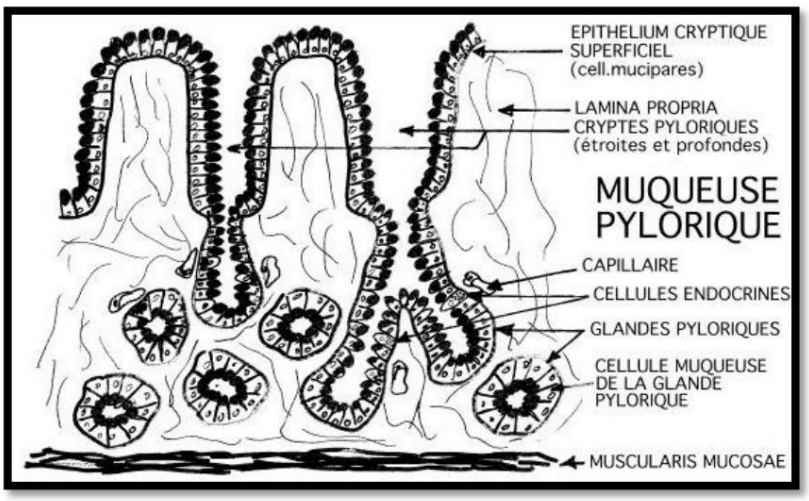


IV.4.1.2 The pyloric mucosa

The pyloric mucosa is 0.4 to 0.5 mm thick, thinner than the fundic mucosa follows the latter in the pyloric region, after a transition zone of some centimeter where the two types of mucosa are intertwined. The lining epithelium has a more irregular in appearance and invaginates into deep crypts at the bottom of which open The pyloric glands. These are convoluted, branching tubular glands which include two cell types.

a-Exocrine cells : produce no more mucus. In electron microscopy the secretory granules appear to consist of an internal protein core, containing pepsinogen surrounded by mucins.

b - Endocrine cells : belong to the diffuse endocrine system of the digestive tract, among which we recognize enterochromaffin cells, gastric cells which are the most numerous, but also gastrointestinal cells, and secretin-producing cells.



IV.4.1.3 The cardiac mucosa

It occupies the region surrounding the opening of the esophagus. The transition with the
The fundic mucosa forms abruptly; it is covered by the lining epithelium.
gastric and includes mucous glands made up of exocrine cells identical to
that of the pyloric mucosa.

The chorion is distributed among the different types of glands and is composed of connective tissue.
loose membrane containing capillaries and cells: fibroblasts, lymphocytes, plasma cells,
Mast cells and polymorphonuclear leukocytes.

The mucosa is bordered internally by the muscularis mucosae layer, which is responsible for
The formation of gastric folds visible when the stomach is empty. It has a structure
more complex than in other parts of the digestive tract with two layers; one external to
longitudinal and internal circular arrangement. From this last one, small bundles extend which
they rise into the chorion to form the mucosal elevations that can be classified
in minor and major folds according to their importance. The folds have a sinuous path and are
anastomosed with each other.

IV.4.2 The submucosa

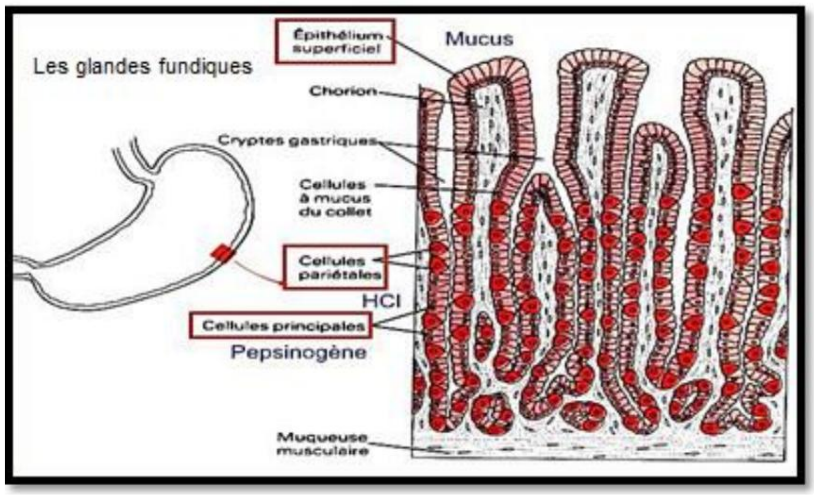
It is made up of relatively dense connective tissue containing many cells
free cells (lymphocytes, plasma cells, etc.) and large blood and lymphatic vessels
size. Nerve elements of the Meissner's plexus are found there.

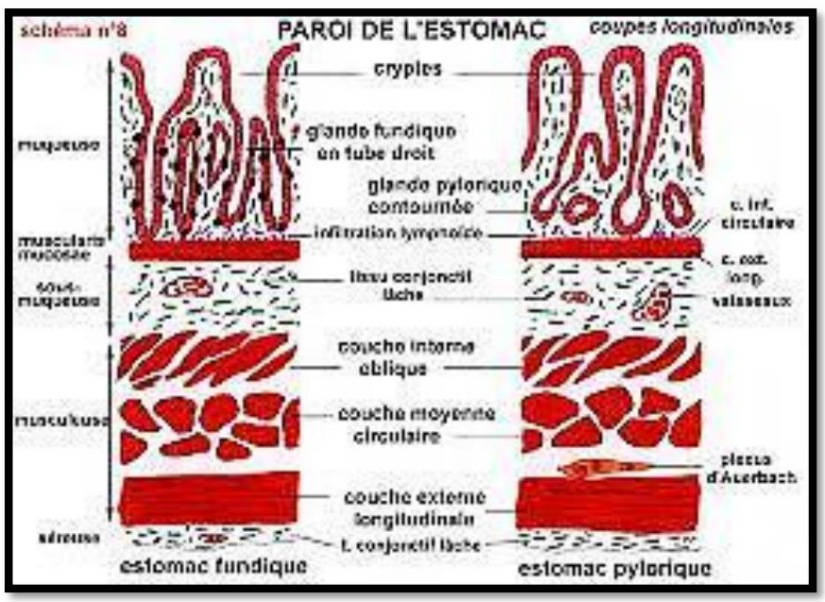
IV.4.3 The muscular

The muscular tunic of the stomach is highly developed and, in contrast to the rest of the The digestive tract consists of three outer layers: longitudinal, middle circular, and inner oblique. Between the different layers of the muscularis, nerve elements of the Auerbach's plexus.

IV.4.4 The Serous

As an intra-abdominal organ, the stomach is covered by a serosa which is a Differentiation of the visceral layer of the peritoneum; the mesothelium. It has numerous trunks blood and lymphatic vessels and nerves.





• **Histophysiology of the stomach**

The stomach has a dual function, mechanical and secretory. Furthermore, the cells
The epithelial cells of the mucosa are subject to constant renewal.

ÿ **Mechanical function**

The stomach receives a mixture of solid and liquid elements from swallowing and the
It is eliminated into the intestine in a fluid form, the chyme. Food mixing is carried out by...
peristaltic waves involving the muscular layers of the organ.

ÿ **Secretion function**

The stomach produces and secretes, via exocrine pathways, a number of compounds constituting the gastric juice, but it also acts like an endocrine gland.
Exocrine secretion includes water, mucus, hydrochloric acid, and various other substances.
substances of a protein nature (enzymes) or glycoprotein nature.
Mucus is produced by superficial epithelial cells and mucous cells.
pyloric glands. This secretion results in the formation of a lubricating mucoid film
and a protective covering for the gastric cavity.
The secretion of HCl is characteristic of the bordering glands.
Pepsinogen secretion is carried out by the chief cells of the fundic glands.
Exocrine secretion also involves intrinsic factor glycoproteins produced by the
parietal cells.

Endocrine secretion is ensured by certain glandular cells possessing a function
endocrine and belonging to the diffuse endocrine system of the digestive tract.

ÿ **Mucosal renewal**

The renewal of the gastric mucosa involves both the lining epithelium and
the glands, the superficial epithelial cells undergo intense desquamation in the
lumen of the stomach. The cells of the glands, which are the mucous cells, the cells
main cells, or bordering cells, exhibit a lower renewal rate.

The proliferative region is located at the bottom of the crypts and at the neck of the glands.
From this zone, cells migrate and differentiate either towards the surface epithelium,
either towards the bottom of the glands.

V. HISTOLOGY OF THE SMALL INTESTINE

V.1 General Architecture and Main Functions

Anatomically, the small intestine forms a long tube subdivided into three parts: the duodenum, the jejunum and the ileum. Histologically, however, these three regions present a large structural unit, even if certain particularities allow them to be distinguished from each other.

The main function of this tube is to absorb amino acids and monosaccharides. fatty acids and monoglycerides from food. It reabsorbs a a large quantity of water. Finally, electrolytes contained in salivary secretions, Gastric and pancreatic substances are also reabsorbed.

This absorptive role of the intestine implies that its mucosa has a large surface area, which is achieved thanks to four characteristics: the great length of the tube, the presence of macroscopic circular folds of the mucosa (valves connivents or Kerckring's), the development of multiple evaginations of the mucosa visible under a magnifying glass (intestinal villi) and finally the modification of the apical pole of the cells absorbents that exhibit numerous microvilli, observed especially under a microscope electronic.

The valvulae conniventes, made up of a supporting tissue identical to the submucosa, form folds that protrude into the intestinal lumen. They are covered with mucosa. More numerous in the duodenum and jejunum, these valves become less frequent and then disappear as one progresses through the ileum. These are structures tall and thick permanent hair.

The villi are formed solely from the covering epithelium resting on the chorion. At the base of each villus, several glands or crypts of Lieberkühn located in the chorion.

These villi can be considered the functional units of the small intestine. Their shape varies from one section of the intestine to another, but also from one individual to another. Overall, they are cylindrical, finger-shaped, and are all the less higher as we get closer to the large intestine

The appearance of villi at the junction between the pylorus and the duodenum is sudden and marks the passage from the gastric mucosa to the intestinal mucosa. Each of them is

formed of a connective tissue axis or chorion into which an arteriole from the network advances submucosal vascular. This arteriole loses its media and runs along the entire axis of the villus. without giving rise to collateral damage. At its extremity, it gives rise to a very rich network of operculated capillaries that come into contact with the basal lamina on which rests the epithelium.

A venule, running parallel to the arteriole, collects the blood and carries it to the submucosa. Finally, at the center of the villus axis, there is a lymphatic capillary, called central chyliferous plant.

The lamina propria of each villus also contains smooth muscle cells originating from the muscular mucosae. By contracting, they reduce the height of the villi and thus cause the evacuation of lymph.

Finally, the intestinal mucosa contains endocrine cells that produce various hormones.

V.2 The mucous membrane

V.2.1 The intestinal epithelium

It is a simple columnar epithelium made up of absorptive cells or enterocytes and goblet cells.

V.2.1.1 Enterocyte Histology

The enterocyte, prismatic in shape, rests on a basal lamina and is strongly attached to its neighbors by junctional complexes, located a short distance from the lumen of the digestive tract. At their base, the enterocytes spread apart from each other to form basolateral spaces. one side of which is formed by the basal lamina. It is through this space, in particular, that lipids pass through, leaving the enterocyte to reach the central lacteal of the villus.

At their apical pole, enterocytes possess a striated or absorptive border made up of microvilli. These considerably increase the surface area absorption by enterocytes.

Enterocytes synthesize various enzymes and have a short lifespan, on the order of 3 at 6 days, and then they shed their skin in the light where they mix with food; that is

primarily, as well as their enzymes, will be able to, in conjunction with secretions
pancreatic, to complete the digestions started in the stomach.

V.2.1.2 Goblet cells

They are scattered among the enterocytes but are less numerous than the enterocytes themselves. Their
Their name comes from their shape. They constantly synthesize mucus which accumulates.
in their cytoplasm in the form of granules which then hydrate and swell. The two
The lower thirds of the cell thus take on the shape of a calyx body. The upper pole
is trapped between the enterocytes and allows the granules to be expelled into the lumen
Intestinal exocytosis. As for the nucleus and cytoplasmic organelles, they are displaced and
compressed at the base of the cell by hydrated mucus granules. The role of this mucus after
Its excretion serves to lubricate the wall.

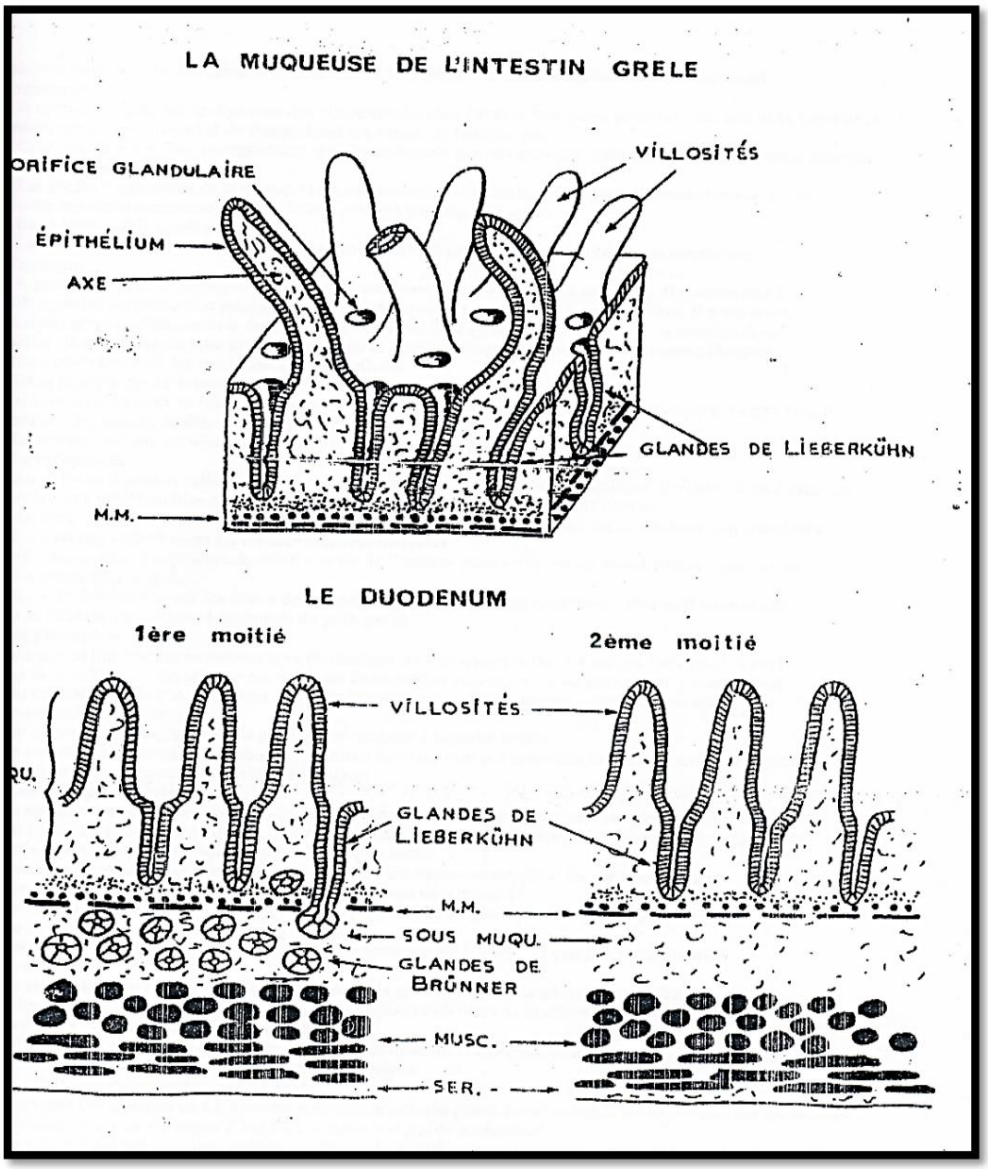
V.2.1.3 The Lieberkuhn Crypts

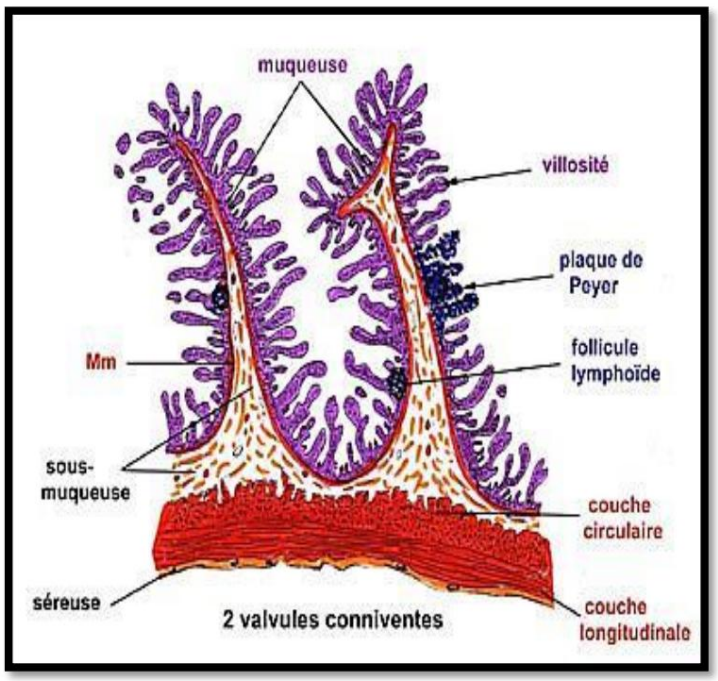
These are simple tubular formations located in the chorion of the mucosa and
which converge towards the base of the villi. The epithelium of these crypts is therefore continuous
with the superficial epithelium.

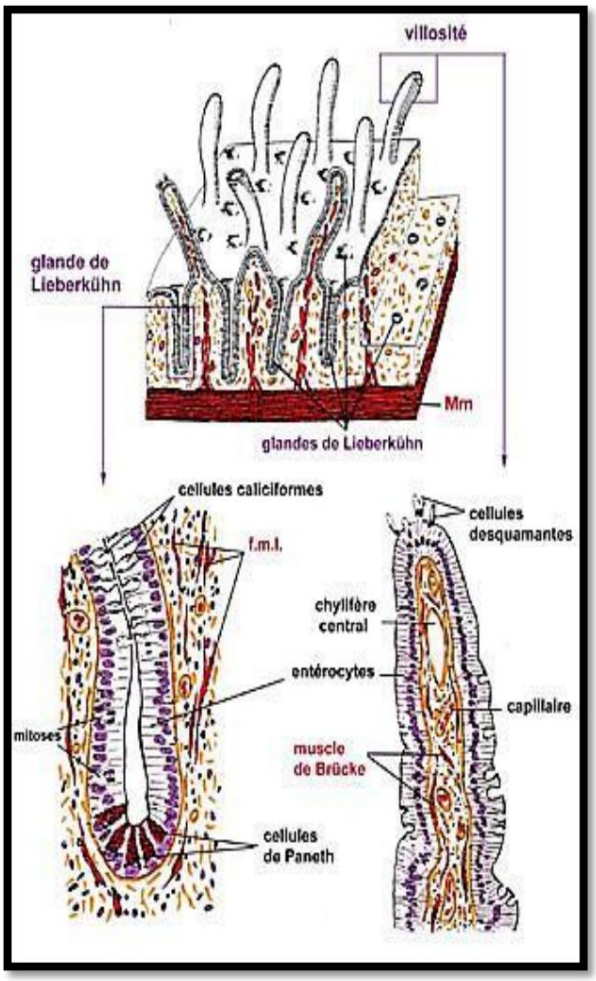
It contains a large number of cells undergoing mitosis, which ensure the renewal of
Enterocytes and goblet cells, whose lifespan does not exceed 3 to 6 days. These
Replacement elements gradually migrate towards the apex of the villi.

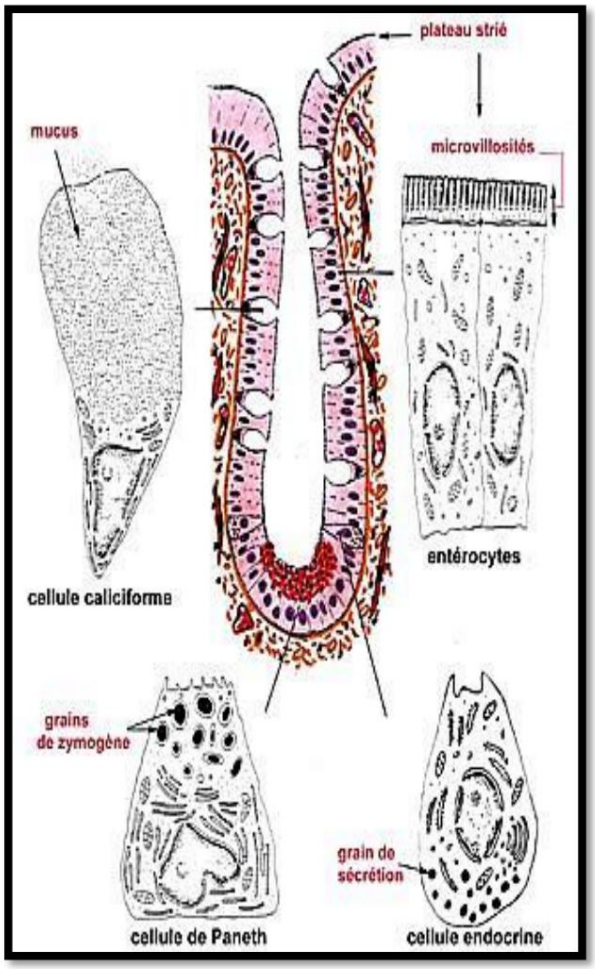
Deep within the crypts are concentrated a few special serous cells called
Paneth. They contain large protein grains whose detailed composition
remains unknown but which contain at least lysozyme, defensins and a protein
highly cationic, bactericidal substances that play a role in maintaining
to disinfect the crypts. These cells are capable of phagocytosis and have a lifespan
longer than those of other epithelial cells.

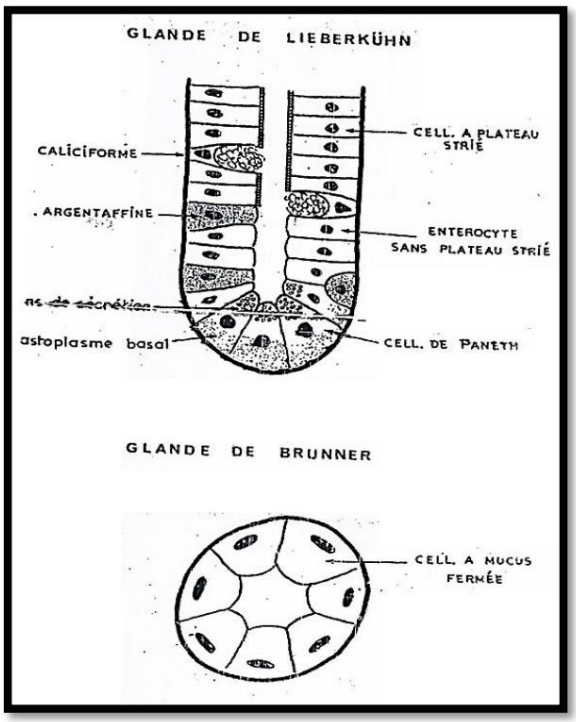
Finally, the crypts contain endocrine cells.

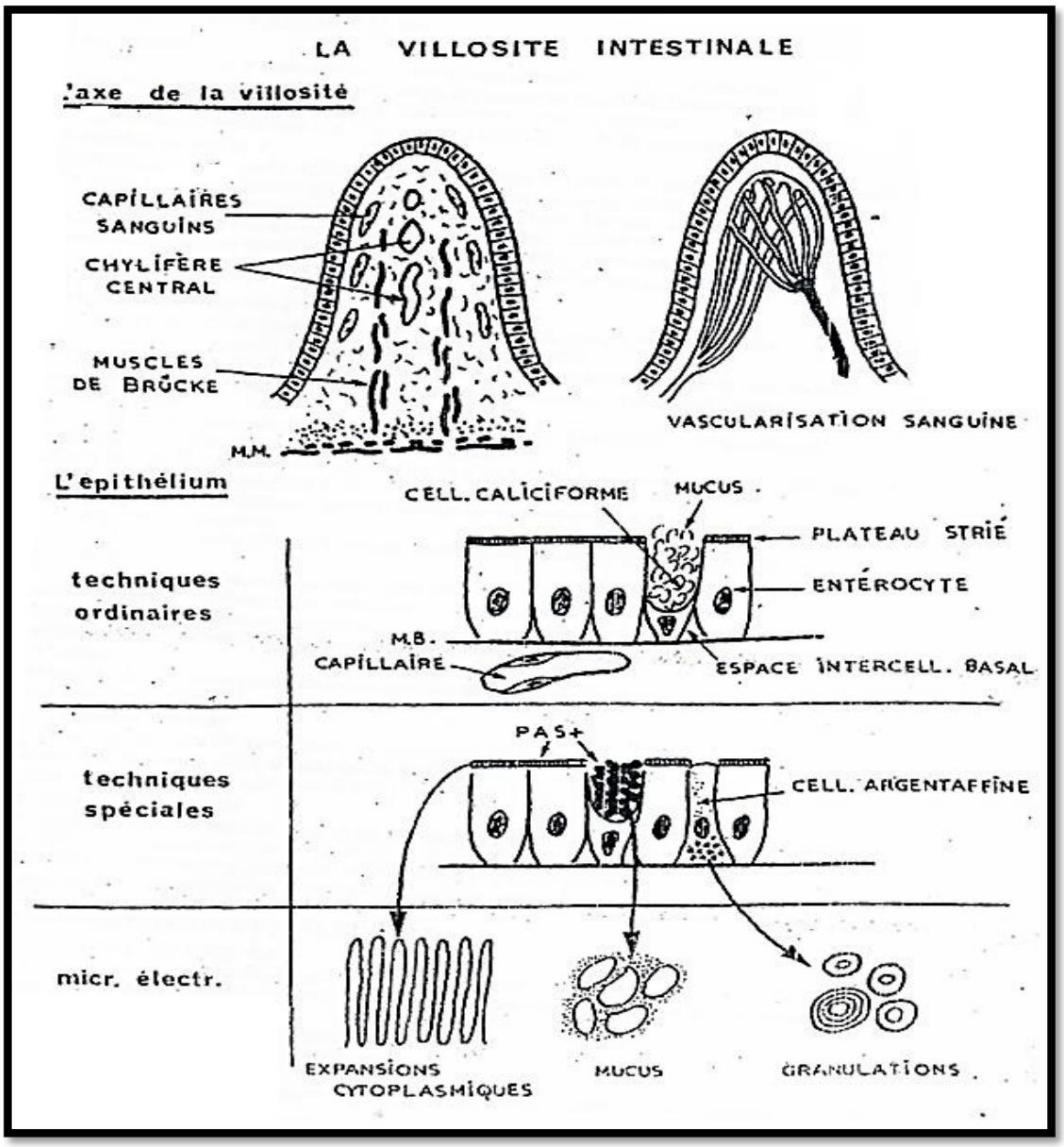

LA MUQUEUSE DE L'INTESTIN GRELE
ORIFICE GLANDULAIRE
VILLOSITÉS
ÉPITHÉLIUM
AXE
GLANDES DE LIEBERKÜHN
M.M.
LE DUODENUM
1ère moitié
2ème moitié
VILLOSITÉS
GLANDES DE LIEBERKÜHN
M.M.
SOUS MUQU.
GLANDES DE BRÜNNER
MUSC.
SER.


muqueuse
villosité
plaque de Peyer
follicule lymphoïde
Mm
sous-muqueuse
couche circulaire
séreuse
couche longitudinale
2 valvules conniventes


villosité
glande de Lieberkühn
Mm
glandes de Lieberkühn
cellules caliciformes
f.m.l.
chylifère central
entérocytes
mitoses
muscle de Brücke
cellules de Paneth
cellules desquamantes
capillaire


plateau strié
mucus
microvillosités
entérocytes
cellule caliciforme
grains de zymogène
grain de sécrétion
cellule de Paneth
cellule endocrine


GLANDE DE LIEBERKÜHN
CALICIFORME
ARGENTAFFINE
CELL. A PLATEAU STRIÉ
ENTEROCYTE SANS PLATEAU STRIÉ
CELL. DE PANETH
GLANDE DE BRUNNER
CELL. A MUCUS FERMÉE


LA VILLOSITE INTESTINALE
l'axe de la villosité
CAPILLAIRES SANGUINS
CHYLIFÈRE CENTRAL
MUSCLES DE BRÜCKE
M.M.
VASCULARISATION SANGUINE
L'epithélium
techniques ordinaires
CELL. CALICIFORME
MUCUS
PLATEAU STRIÉ
ENTÉROCYTE
M.B.
CAPILLAIRE
ESPACE INTERCELL. BASAL
techniques spéciales
PAS+
CELL. ARGENTAFFINE
micr. électr.
EXPANSIONS CYTOPLASMIQUES
MUCUS
GRANULATIONS

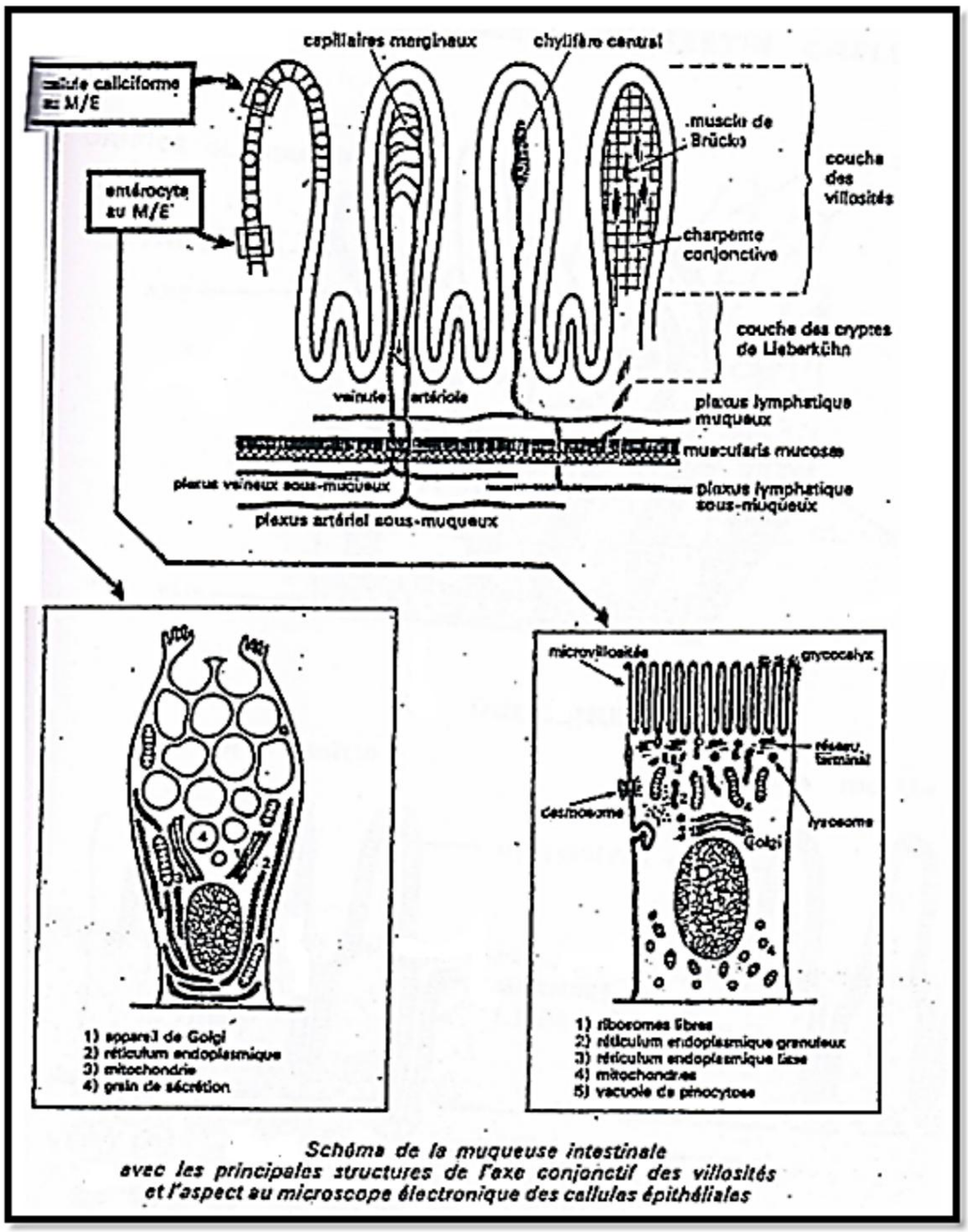


Schéma de la muqueuse intestinale avec les principales structures de l'axe conjonctif des villosités et l'aspect au microscope électronique des cellules épithéliales

ÿ **Other structures of the small intestine**

Many so-called saprophytic germs live permanently in the intestinal lumen.

Other pathogens can also establish themselves there. In order to limit the risk of excessive proliferation of the former and even more so of the latter, the intestinal wall is rich in cells of the system immune system (lymphocytes, plasma cells, macrophages).

These are either dispersed in the chorion of the mucosa, or grouped in lymphoid follicles become more numerous and larger the closer one gets to the ileocecal valve. These follicles can even protrude into the submucosa at the across the muscularis mucosae. In the terminal portion of the ileum they are numerous and large and form true plates: Peyer plates.

V.2.2 The muscularis mucosae

Muscle fibers detach from the muscularis mucosae and penetrate into the villi. By contracting rhythmically (6 times per minute), particularly during During digestion, they compress the lacteals and facilitate their emptying.

V.3 The submucosa

In the submucosa of the duodenal region, especially near the pylorus, one It contains compound tubular mucous glands called Brunner's glands. They produce a mucus with an alkaline pH which, along with pancreatic secretions, participates in the neutralization of Gastric chyme.

V.4 The muscular

The muscularis propria has an inner circular layer and an outer longitudinal layer of smooth muscle between its layers is the Auerbach nerve plexus, as in the other parts of the digestive tract. In fact, two muscular layers exhibit a coiling helical with large steps for the external and small steps for the internal.

V.5 The serous membrane

As in the stomach, the serosa is formed by a layer of connective tissue covered of a mesothelium.

VI. HISTOLOGY OF THE LARGE INTESTINE

The large intestine's main function is to absorb water from the food bolus. It has neither There are no valvulae or villi. The covering epithelium invaginates and forms Lieberkühn crypts deeper than those of the hail.

On the other hand, the large intestine contains fermentation bacteria and bacteria putrefaction produces, in particular, vitamins B12 and K. Their activities do not manifest themselves through no particular morphological aspect.

VI.1 The epithelium

It is composed of enterocytes and goblet cells. The latter are found in large numbers number in the crypts. They produce abundant mucus essential for to facilitate the passage of feces, which become increasingly solid as one progresses brings closer to the anus.

Enterocytes have an apical pole covered with microvilli but do not possess not the enzymatic equipment of the small intestine.

The absorptive plate of enterocytes allows for the recovery of a large part of the water contained in the matter leaving the small intestine. This water absorption depends on active reabsorption of Cl-. As one moves away from the In the colon, the feces become increasingly solid, but lubrication decreases. greater due to the progressive increase in the number of goblet cells allows them to slide without damaging the wall.

VI.2 The chorion

It is similar to that of the small intestine. It contains lymphoid follicles scattered, often so large as to encroach upon the submucosa. The muscularis mucosae is unremarkable.

VI.3 The muscular

This tunic is formed by two layers of smooth muscle cells, one available circular, the other with longitudinal arrangement, the inner circular layer can be reinforced locally and form true anatomical sphincters.

- The muscularis propria has a particularity: while the inner circular layer is typical, Its outer longitudinal layer is very thin and has reinforcements. longitudinal bands (muscular bands) giving it a discontinuous appearance. The strips are recognizable to the naked eye.
- Between the two layers is a powerful elastic network and, of course, the Auerbach's plexus.

The muscular tunic also features sphincter reinforcement, the ileo- valve

cecal at the origin of the large intestine, preventing the reflux of matter into the small intestine and which is the

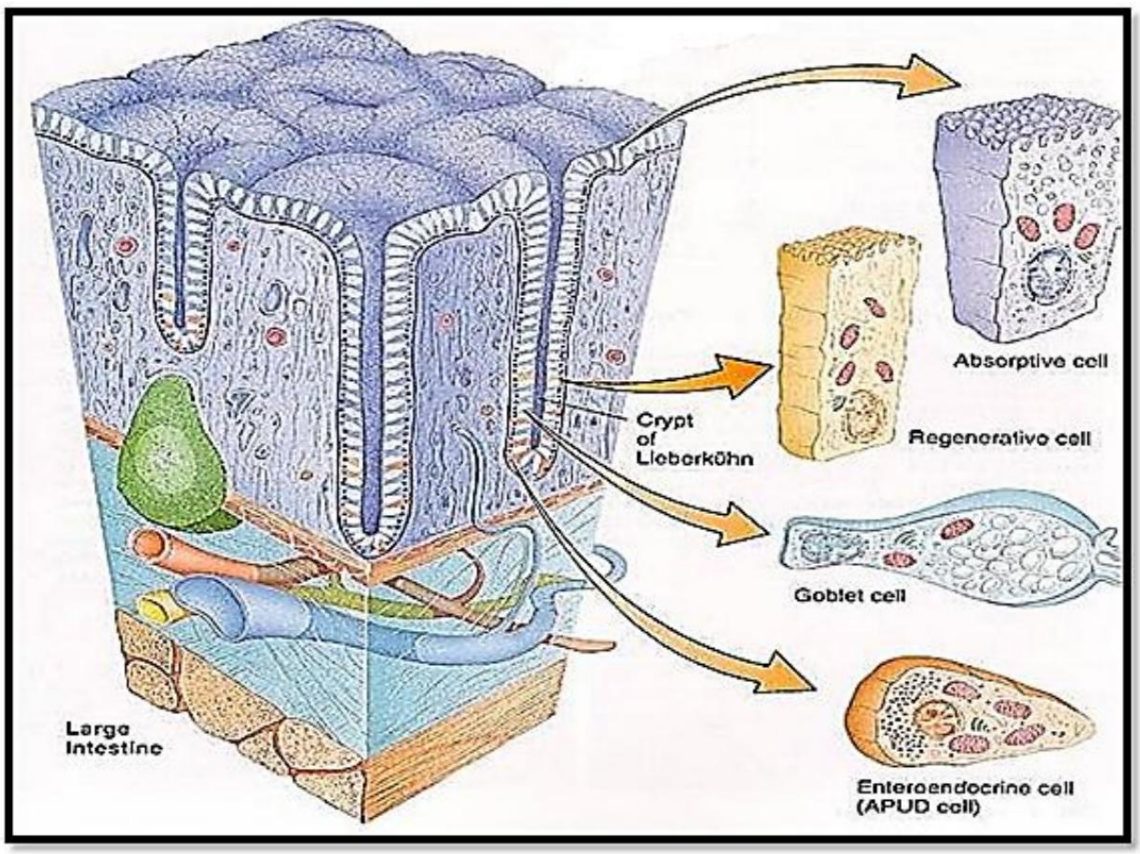
starting point of peristaltic contractions. Another smooth muscle sphincter is located at the end

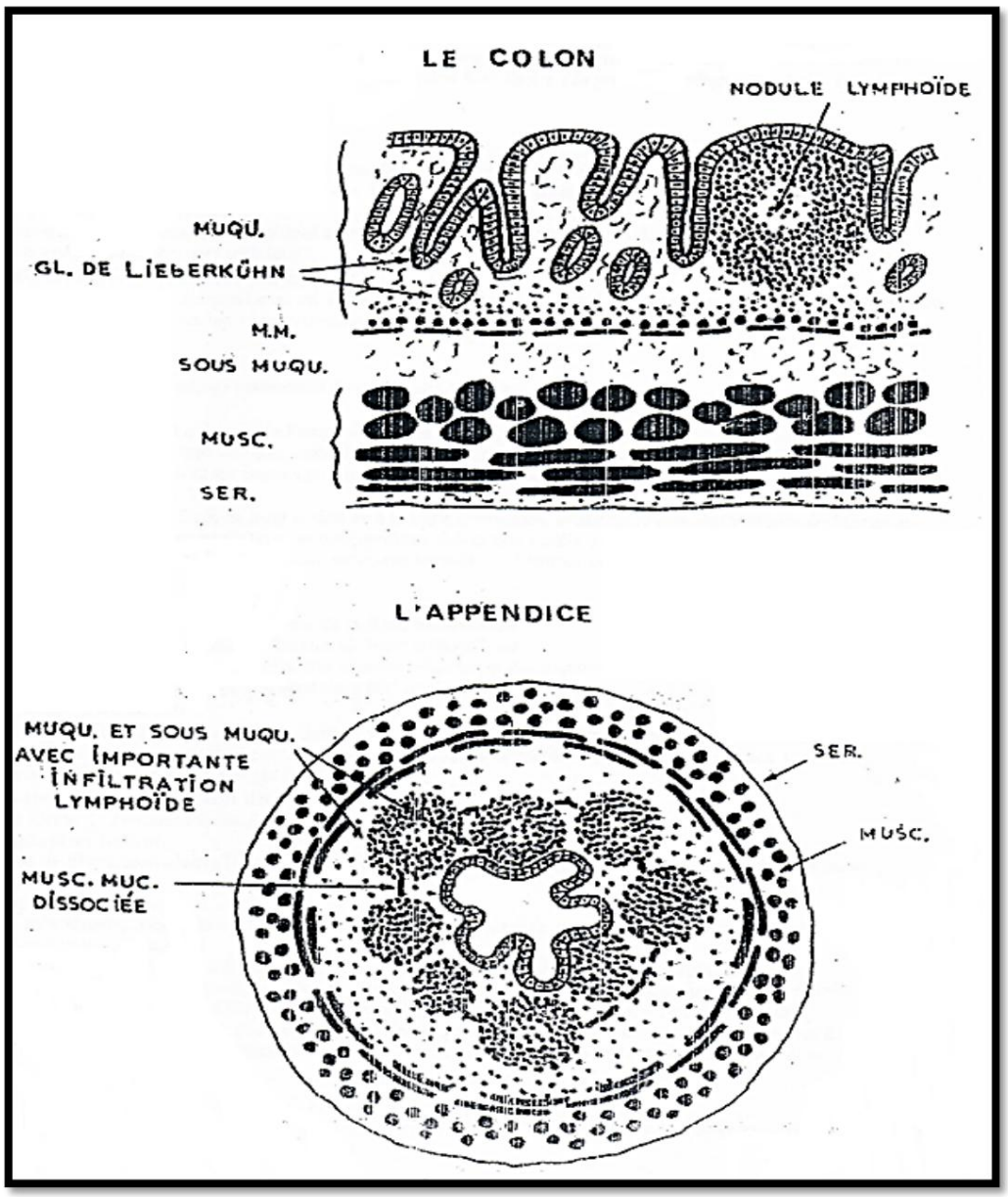
lower part of the rectum, it is lined with a striated sphincter.

VI.4 The Serous

The adventitia has no special characteristics except that, at the level of the free part of the intestine, there are...

large adipose lobules.




LE COLON
NODULE LYMPHOÏDE
MUQU.
GL. DE LIEBERKÜHN
M.M.
SOUS MUQU.
MUSC.
SER.
L'APPENDICE
MUQU. ET SOUS MUQU. AVEC IMPORTANTE INFILTRATION LYMPHOÏDE
SER.
MUSC.
MUSC. MUC. DISSOCIÉE

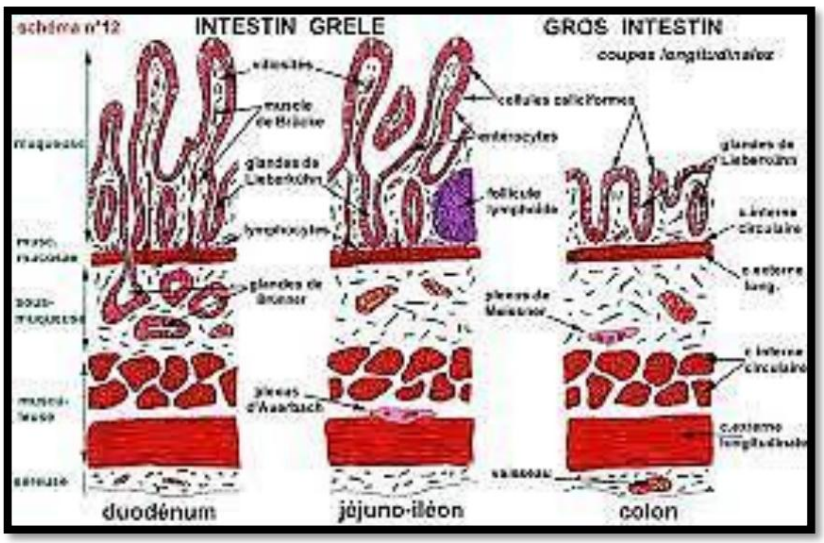


schéma n°12
INTESTIN GRELE
GROS INTESTIN
coupes longitudinales
duodénum
jéjuno-iléon
colon

• Histophysiology of the small intestine

The small intestine plays a role in propelling food through the digestive tract. It is the site of the following functions absorption and has an exocrine and endocrine secretion role. In addition, it participates in the the body's immune defenses and the epithelial cells that constitute them, are subject to significant renewal.

ÿ **Propulsion of the food bolus**

The progression of the food bolus occurs in a unidirectional manner from the duodenum. up to the ileocecal junction. The intestine is the site of waves of contractions, defining the Peristalsis. These waves are caused by the contraction of the layers of the muscularis propria. dependent on the Auerbach plexus which plays an important driving role.

ÿ **Absorption function**

Intestinal absorption depends primarily on the considerable increase in surface area useful (intestinal loop, valvulae conniventes, villi, striated border) which can reach 200 square meters. This function is performed by enterocytes and more specifically by properties of the microvilli membrane coating.
The cellular mechanisms involved differ depending on the substances absorbed.

ÿ **Secretion functions**

The intestine has a dual secretory function: exocrine and endocrine.
Exocrine secretion consists of the production of intestinal juice which contains water, electrolytes from the mucus produced by goblet cells, and protein enzymes are produced by paneth cells, plasma-derived proteins (immunoglobulins) and formed elements (leukocytes).
The cells belonging to the diffuse endocrine system of the digestive tract and located in the intestine produce a significant number of peptide hormones or neurotransmitters involved more or less directly in the physiology of the digestive tract.

ÿ **Immune defense functions**

The digestive tract is in constant contact with antigens provided by food; these the latter come into contact with the immune cells of the lymphoid follicles of the

chorion thanks to the intervention of particular epithelial cells or M cells (membrane-
(like epithelial cell).

ÿ **Renewal of the intestinal epithelium**

The intestinal epithelium undergoes significant desquamation, which occurs at the apex of the villi. Cell renewal is ensured by intense mitotic activity at the
level of a germinal zone located deep within the glands, from this zone
the cells migrate towards the tips of the villi or towards the bottom of the Liberkuhn glands.

• Histophysiology of the large intestine

The colon is not only a reservoir, but also an organ of absorption and secretion.
The mucous membrane secretes a considerable amount of mucus, much more viscous than that of the small intestine playing a role in the agglutination of fecal matter during its mobilization and in resistance to germs that are so abundant.

CHAPTER 2

HISTOLOGY OF THE DIGESTIVE GLANDS

I. HISTOLOGY OF THE SALIVARY GLANDS

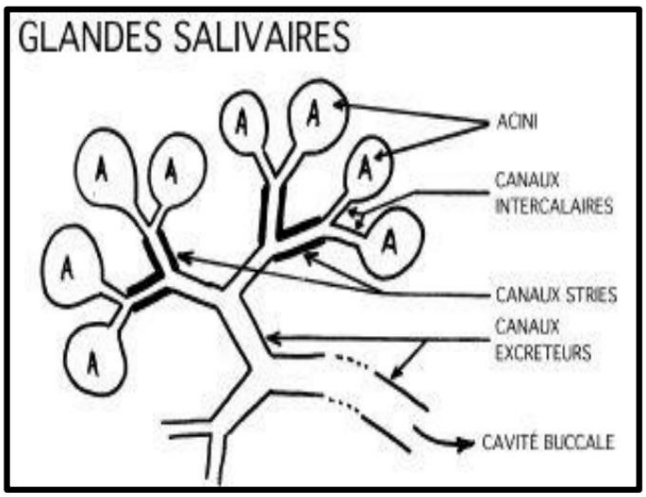
I.1 General Architecture

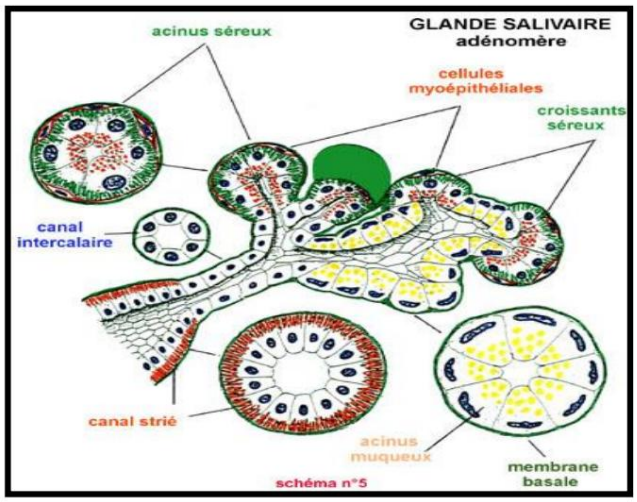
There are 3 pairs of so-called main salivary glands and a multitude of smaller glands.
accessories distributed throughout the oral mucosa, including that of the tongue.
All these elements are located in the chorion.

The main glands are the parotid glands, which produce approximately 25% of saliva.
submandibular (70%) and sublingual (5%).

All these glands are surrounded by a connective tissue capsule from which septa extend.
which penetrate the parenchyma and delineate lobules. Vessels and nerves use
these partitions extend from the hilum to disperse into the gland.

The glandular tissue itself is of the acinar type, composed in the parotid glands, tubo-
Acinar compound in other glands. Small collecting tubes called ducts
Intercalated layers, formed of a flattened, single-layered epithelium, collect saliva from the acini;
confluent to form intralobular channels, often striated, which become channels
interlobular in the conjunctival septa.





I.2 Histology of glandular tissue

It is composed of serous cells and/or mucous cells and represents a good model
of these two types.

A serous cell is a glandular cell that synthesizes and secretes proteins.
exhibits polarity; the base contains the rounded nucleus with dispersed and voluminous chromatin
nucleolus and organelles necessary for protein synthesis; at the apical pole accumulate
before exocytosis the protein granules called serous.

In many cases of exocrine glands, the serous cells group together in clusters at
within which a layer of glandular cells are organized around a central lumen
to form a small hollow sphere called a serous acinus.

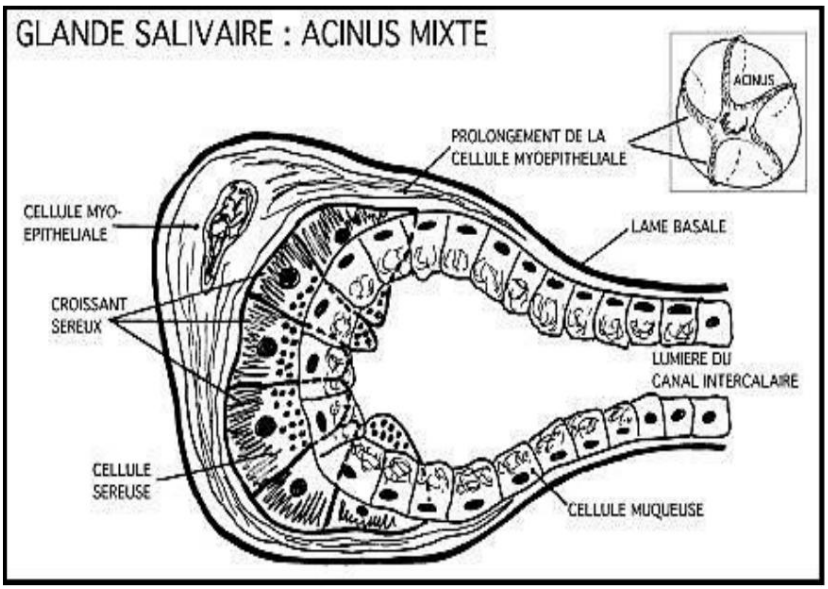
A mucous cell produces mucus. The glycoprotein granules and
The glycosaminoglycans that make up this structure in the cell accumulate at the apical pole. They
They hydrate rapidly and swell at the time of their exocytosis.

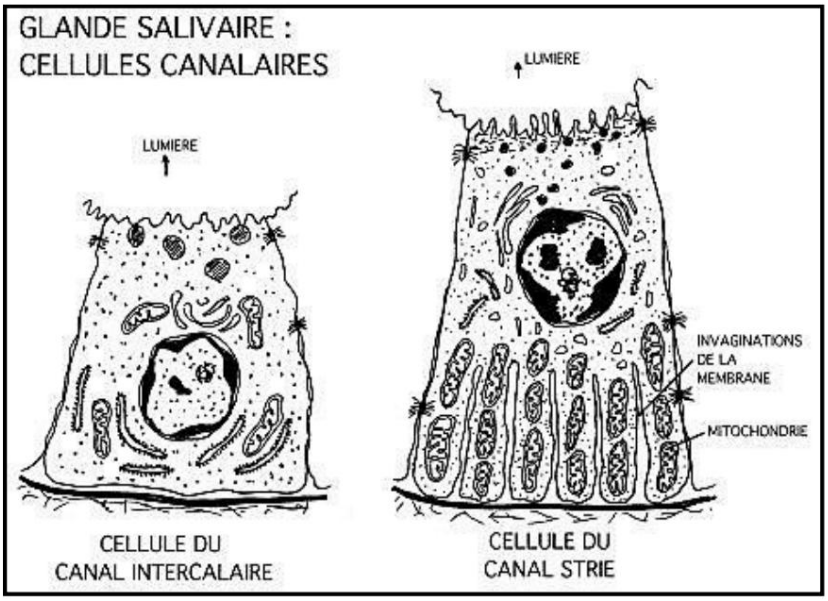
During fixation, the mucigen granules expand abruptly. As a result, the organelles
The intracytoplasmic cells and the nucleus are compressed and pushed to the base. Therefore, this nucleus...
deformed and smaller in volume than in a serous cell. Mucous cells
form the mucous acini.

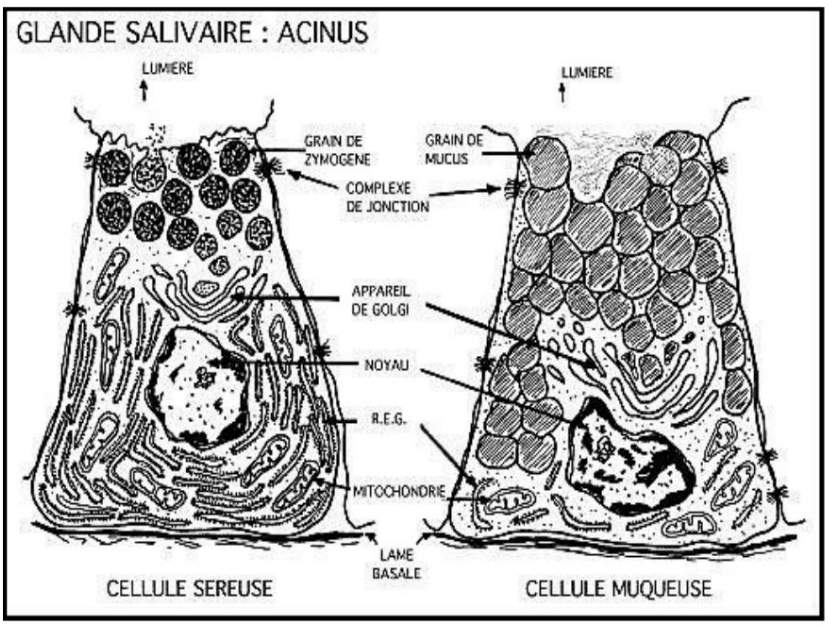
Mixed acini contain both serous and mucous cells. In this case, the
Mucous cells line the glandular lumen while serous cells form a
A crescent (Gianuzzi crescent) attached to the outside of the acinus. Narrow spaces are created.
between the mucous cells allow the products excreted by the serous membranes to reach the
lumen of the gland.

Salivary glands can contain various types of acini. Parotid glands
contain exclusively serous cells, the submandibular cells a majority of cells
serous, and sublingual a large number of mucous cells.

At the periphery of the salivary gland acini, between the basement membrane and the base, one finds
glandular cells and myoepithelial cells. Their contraction facilitates exocytosis of
saliva granules.


GLANDE SALIVAIRE : ACINUS MIXTE
ACINUS
PROLONGEMENT DE LA CELLULE MYOEPITHELIALE
CELLULE MYO-EPITHELIALE
LAME BASALE
CROISSANT SEREUX
LUMIERE DU CANAL INTERCALAIRE
CELLULE SEREUSE
CELLULE MUQUEUSE


GLANDE SALIVAIRE : CELLULES CANALAIRES
LUMIERE
LUMIERE
INVAGINATIONS DE LA MEMBRANE
MITOCHONDRIE
CELLULE DU CANAL INTERCALAIRE
CELLULE DU CANAL STRIE


GLANDE SALIVAIRE : ACINUS
LUMIERE
LUMIERE
GRAIN DE ZYMOGENE
GRAIN DE MUCUS
COMPLEXE DE JONCTION
APPAREIL DE GOLGI
NOYAU
R.E.G.
MITOCHONDRIE
LAME BASALE
CELLULE SEREUSE
CELLULE MUQUEUSE

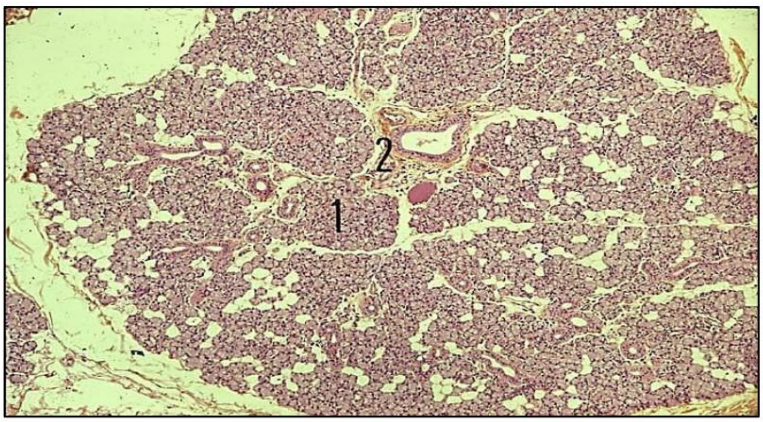
II.3 The parotid gland

The parotid gland is the largest of the glands and belongs to the pure serous type except in the case of carnivores where it is serous and mucous. Its name is justified by its characteristic location. in the immediate vicinity of the base of the ear, occupying the retromandibular fossa or parotid.

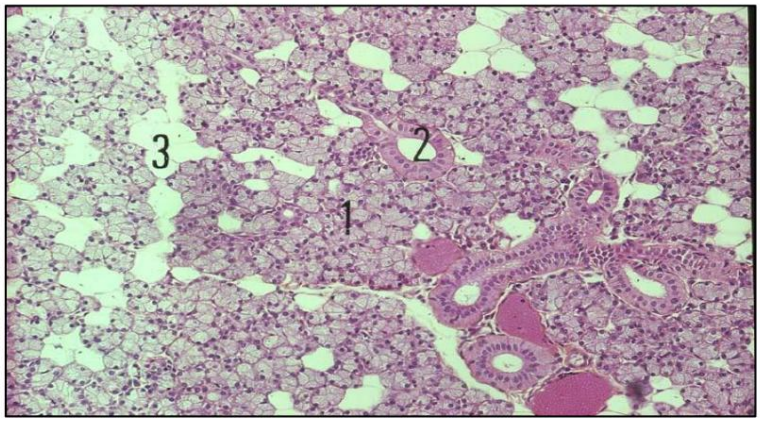
It is a gland whose secretion is released into the mouth through a single, long duct: the parotid duct or Stensen's canal.

The parotid gland has excretory, secretory, and intercalated ducts that produce au- outside the secretion of the serous acini.

It is surrounded by a connective tissue capsule which forms internal partitions delimiting lobules. The acinus is formed of pyramidal cells. There are cells between the secretory cells and the basal layer of myoepithelial cells. The excretory ducts are formed by a short intercalated canal formed by a low cuboidal epithelium which continues the acinus and extends by An intralobular canal formed by cuboidal or columnar epithelium. The inter-channels lobular cells are found in the septa, are formed by a high cuboidal epithelium and converge towards an excretory parotid duct.



Parotid gland : 1- lobulation of the glandular portion, 2- lobes separated by a small component conjunctiva



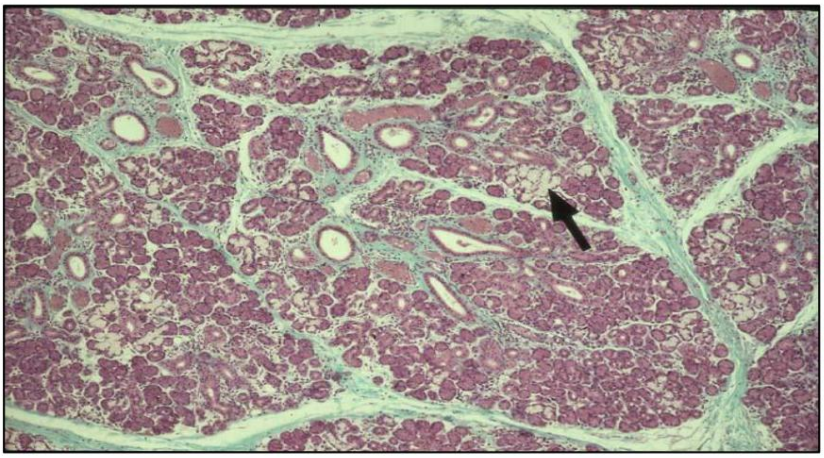
Parotid gland: 1- secretory glandular portion, 2: acinus, 3: adipose cells

I.4 The submaxillary or mandibular gland

It is located medially and caudally at the angle of the jaw, on the side of the region hyoid and pharyngeal, it generally extends under the parotid gland or even as far as under the wing of The atlas. It is a conglomerate and mixed gland, predominantly serous or mucous depending on the species. It exhibits very large differences in appearance and especially in volume and weight in mammals.

The gland has a lobular texture but may be looser than that of the parotid gland in men. Equines and ruminants have a narrower duct, while carnivores and rabbits have a narrower duct. is Wharton's duct, which opens into the floor of the mouth. The gland is formed of lobules delimited by trabeculae of connective tissue.

In the loose interlobular connective tissue (CT) are more collecting ducts large blood and lymphatic vessels and autonomic nerve fibers. The TC Interlobular fibrous connective tissue continues with intralobular reticular connective tissue. As in the parotid gland, there are excretory and intercalated ducts in the submandibular gland but The latter are short and difficult to find. The terminal secretory units are either serous acini, or mucous tubules with serous terminal caps resembling a crescent or a crescent moon in histological section, Gianuzzi or Von Ebner crescents. The cells of The acini are acidophilic like those of the parotid gland; their round nuclei are located at the pole basal. The purely mucous cells of the mucous tubules are distinguished from the cells serous membranes, due to their faint coloration, have dense, flattened nuclei arranged basally or basolateral.



Submandibular

I.5-The sublingual gland

It is a mixed gland, generally predominantly mucous, located beneath the mucous membrane of the floor of the mouth. It is made up not of a single gland but of several lobes.
considered as distinct glands, some conglomerated and others agminated, joined together
in groups or in clusters, represented very diversely depending on the species.

It is the smallest of the salivary glands; it is recognized as a major gland whose ducts
Excretory secretions converge on a single duct: the Bartholin's duct and a minor gland.
drained by multiple conduits: canals of Rivinus

The Bartholin Canal flows into the Wharton Canal, either alongside it or in common with it.

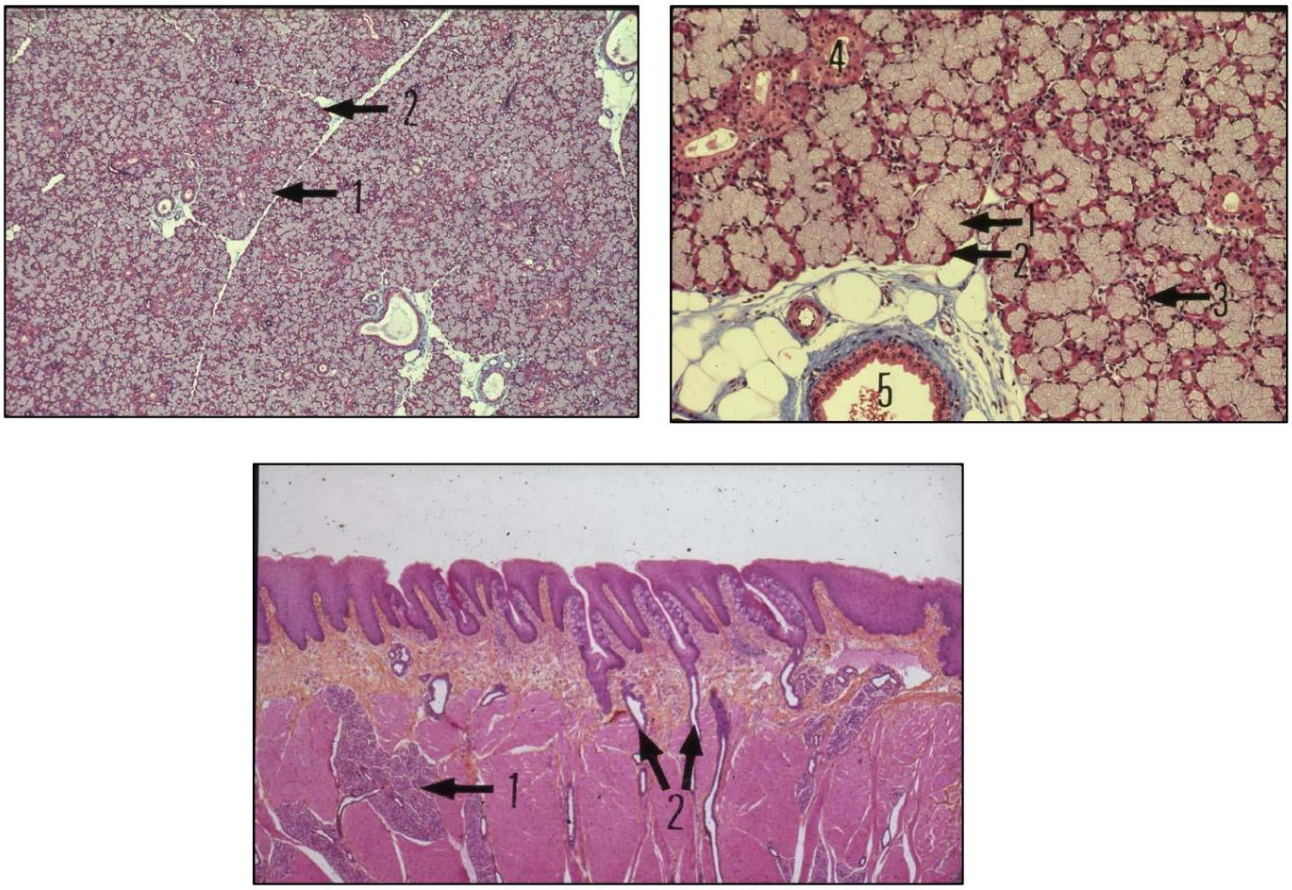
The majority of the gland's acini are mucous, a few are mixed; the serous acini
Pure ones are rare, there is no clear connective tissue capsule but septa are found (of
partitions).

In ruminants (cattle, sheep) the acini are almost all mucous, in carnivores
(dog, cat) there are seromucous acini and serous and mucous acini, the canals
Intercalary spaces are missing. In carnivores, there is the zygomatic gland, and in cats...
molar gland.

• The zygomatic gland is located between the zygomatic arch and the temporal bone, its acini are essentially mucous.

•The molar gland is located in the lamina propria of the mucous membrane of the lower lip near the corner of the mouth.

•The small salivary glands are clusters of serous, seromucous and mucous membranes, located throughout the oral mucosa. There are lingual glands, the Ebner's glands, the labial, palatine and pharyngeal glands.



Sublingual: 1- predominant mucous secretion, 2- serous Gianuzzi crescents, 3- Excretory ducts = intercalated segments, 4- Pflüger's ducts. 5- excretory ducts located in the connective tissue septa.

I.6 Histophysiology of the salivary glands

Saliva plays a mechanical role. The mucus it contains lubricates the food bolus and facilitates Swallowing and the passage of this bolus into the esophagus. The numerous salivary glands Accessories, which are essentially mucous membranes, play an important role in lubrication. of the oral mucosa.

Saliva plays a role in digestion. Amylase, which functions optimally at the pH of saliva, hydrolyzes starch and glycogen from food. This process continues in the stomach where it stops as soon as the acidification of food reaches a certain level.

Saliva protects the oral cavity against infections. Indeed, it contains... immunoglobulin A, some of which are directed against antigens of bacteria present in the mouth. On the other hand, it also contains two bactericidal products: lysozyme and Lactoferrin. Saliva plays a role in taste by dissolving molecules that can then to stimulate the taste buds. The action of certain salivary enzymes or those released by bacteria allow the release of aromas.

Saliva contains growth factors that are probably active during the repair of the oral or esophageal mucosa.

II. HISTOLOGY OF THE LIVER

The liver is a complex gland; its structure lends itself to study:
- Envelopes: one serous and the other fibrous, superimposed;
- A parenchyma made up of countless lobules;
- Excretory ducts, vessels and nerves (Barone, 1984).

II.1. Envelope elements

There are three of them.

- *The serous tunic:* made up of the visceral peritoneum that lines the liver, this envelope is almost complete but does not, however, cover the area nuda and the furrows occupied by the large veins.

- ***The subserosal tissue:*** thin layer on which the serosa rests.

- ***The fibrous tunic:*** or "Glisson capsule", thin, transparent and resistant, it adheres to the subserosa and hepatic tissue. At the level of the liver portal, it reflects to the interior of the organ by forming a sheath (Glissonian Sheath) or fibrous capsule perivascular. This sheath accompanies the bile ducts as well as the branches of the portal branches and of the hepatic artery and surrounds the hepatic lobules (Barone, 1984; Banks, 1981; Pavaux, 1978).

II.2. The hepatic parenchyma

It consists of liver cells arranged in a series of sheets or plaques. perforated, branched and anastomosing which form a spongy tissue or a labyrinth between in which are found the blood sinusoids that converge towards a vessel located in the center of the lobule, the centrilobular vein. (TS Lesson and CR Lesson, 1980; Bevelander, 1973)

II.2.1. The hepatic lobule

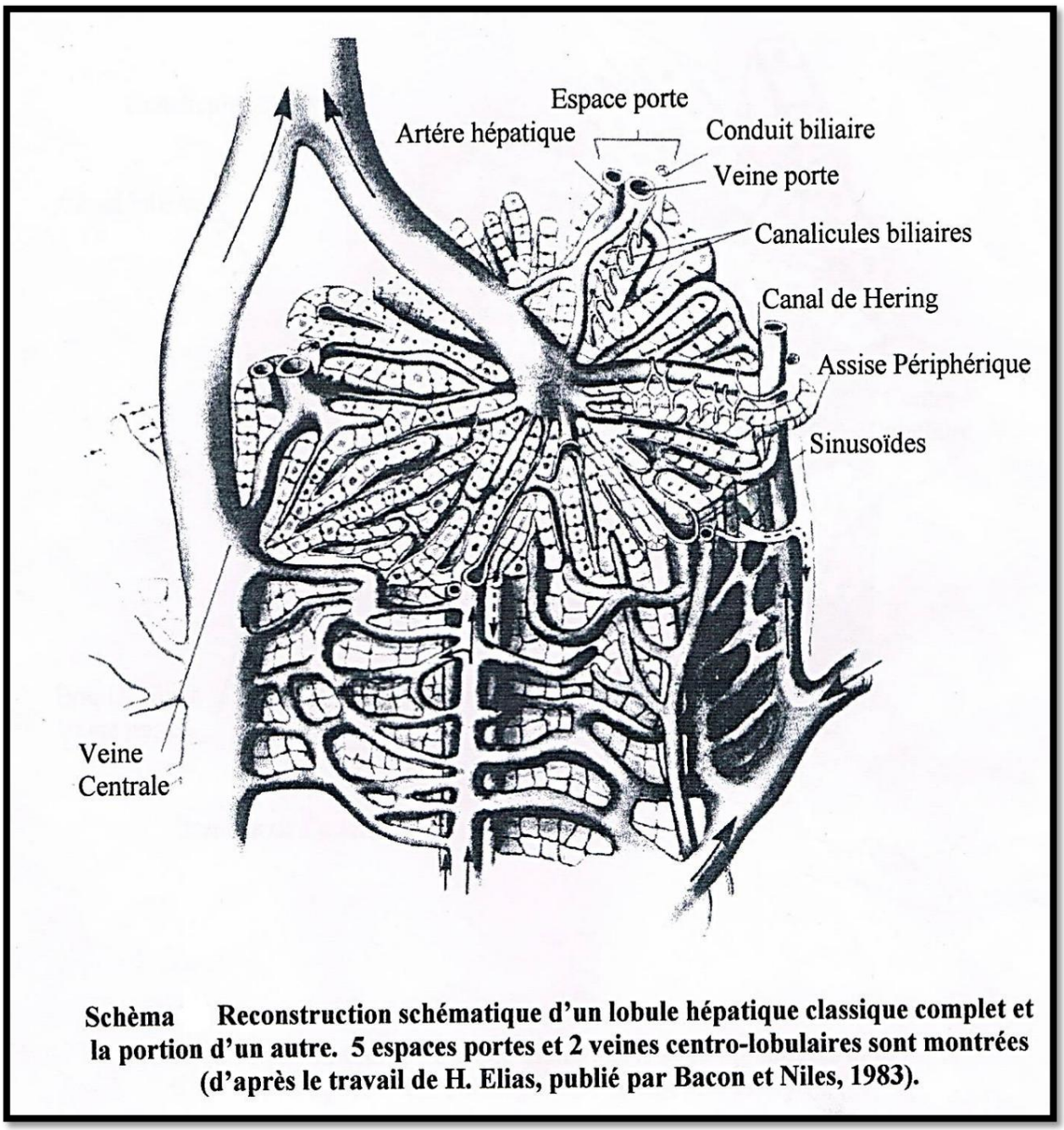
It constitutes the morphological unit of the liver.

The lobules are surrounded by connective tissue that undergoes variable development depending on the species. In ruminants, the septa are barely visible and the lobules appear in continuity with each other (Dessy Doize, 1992).

The liver lobule has a hexagonal shape. Within it, the liver cells are arranged in layers between which the sinusoids are located.

In contact with the lobules is a connective-vascular space: the portal space or space Kiernan's, which consists of a group of connective tissue in a triangular shape. portal spaces constitute, in a way, intrahepatic expansions of the capsule of *Glisson.* They contain a branch of the hepatic artery, a branch of the portal vein, and a bile duct lined by cuboidal epithelium, the whole forming *the portal triad* with generally a lymphatic vessel and nerve fibers (Dessy Doize, 1992; TSLesson, CRLesson, 1980; Bevelander, 1973; Roussy, 1950).

*** The suprahepatic spaces:** contain only one vascular element: the suprahepatic vein hepatic or centrilobular (Roussy, 1950). Between these two spaces are arranged The hepatic trabeculae radiate around the central lobe vein. Each trabecula is formed by two rows of cells (Roussy, 1950).



Schèma Reconstruction schématique d'un lobule hépatique classique complet et la portion d'un autre. 5 espaces portes et 2 veines centro-lobulaires sont montrées (d'après le travail de H. Elias, publié par Bacon et Niles, 1983).

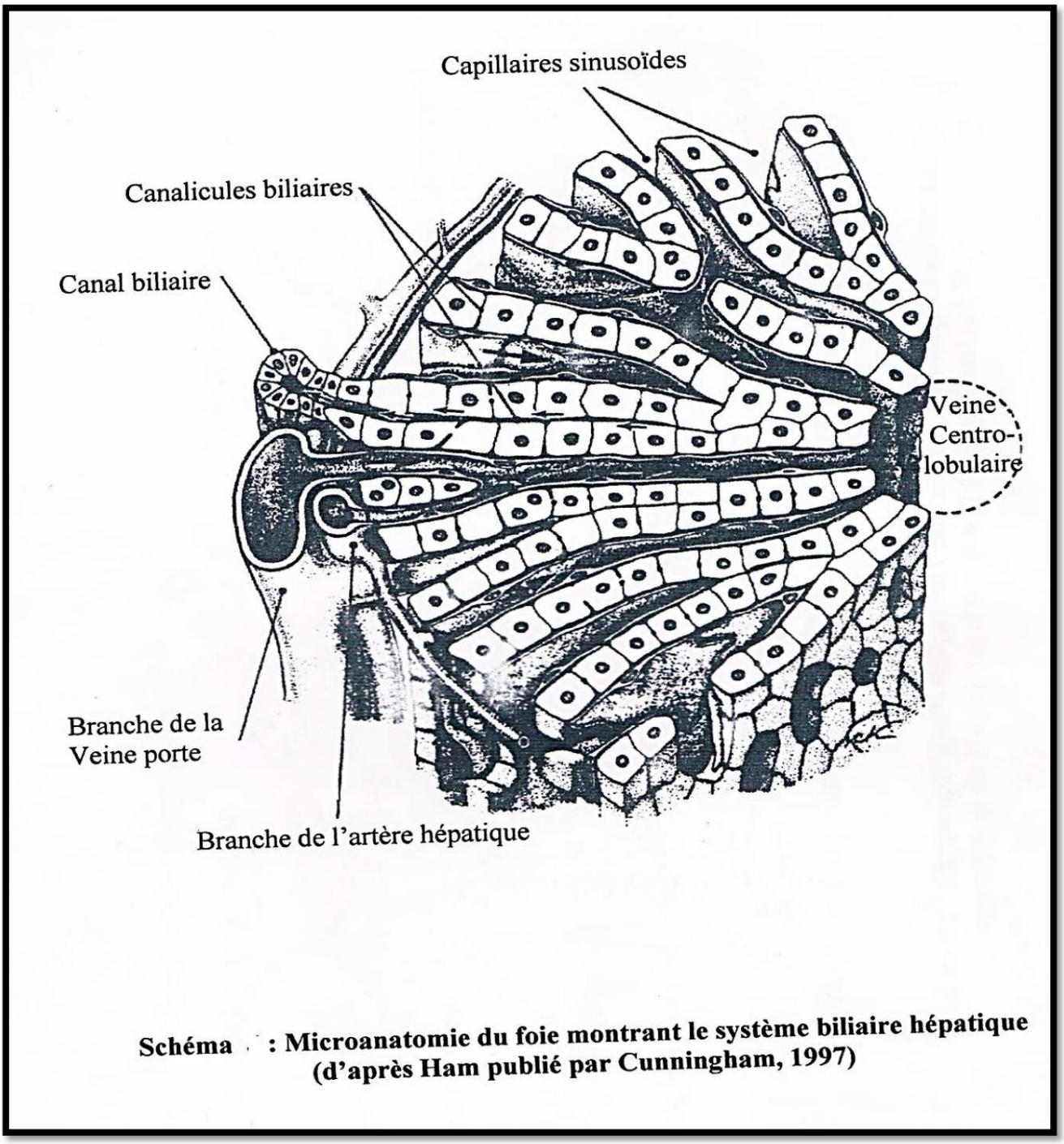


Schéma : Microanatomie du foie montrant le système biliaire hépatique (d'après Ham publié par Cunningham, 1997)

*** The hepatocyte:** is a polyhedral cell 20 to 30 µm in diameter. Its size varies according to the functional and nutritional state of the body (Barone, 1984; TSLesson, CR, 1980; Weather, Burkitt, and Daniel, 1979; Policard, 1944; Branca, 1921). In well-nourished individuals, the Hepatocytes store significant amounts of glycogen and process large quantities of lipids. Each hepatocyte is equipped with: a relatively large, rounded central nucleus, some twice as large, possessing 1 to 2 large nucleoli. (Bacon and Niles, 1983; Reith and Ross, 1965).

Its granular or spongy cytoplasm contains numerous organelles: mitochondria, rough endoplasmic reticulum and smooth endoplasmic reticulum, free ribosomes or grouped into polysomes, a Golgi apparatus, lysosomes, peroxisomes. In addition to the organelles, the cell contains glycogen, lipids and pigments (bile and lipofuschin) (Banks, 1981).

The hepatocyte plasma membrane shows specializations at certain points. At the vascular pole, the presence of numerous microvilli protruding at the cell surface in the space of Disse, the latter being located between the hepatocyte and the endothelium of the sinusoids. At the biliary pole, the membranes of two adjacent cells are in contact with each other except at a kind of gutter, the canaliculus biliary.

*** Hepatic sinusoids:** located between the hepatocyte plates, they are anastomosed and form a vast network interposed between the portal vein and the hepatic vein (centro-lobular) (Branca, 1921). Their wall lacks a basal lamina and contains three types of cells.

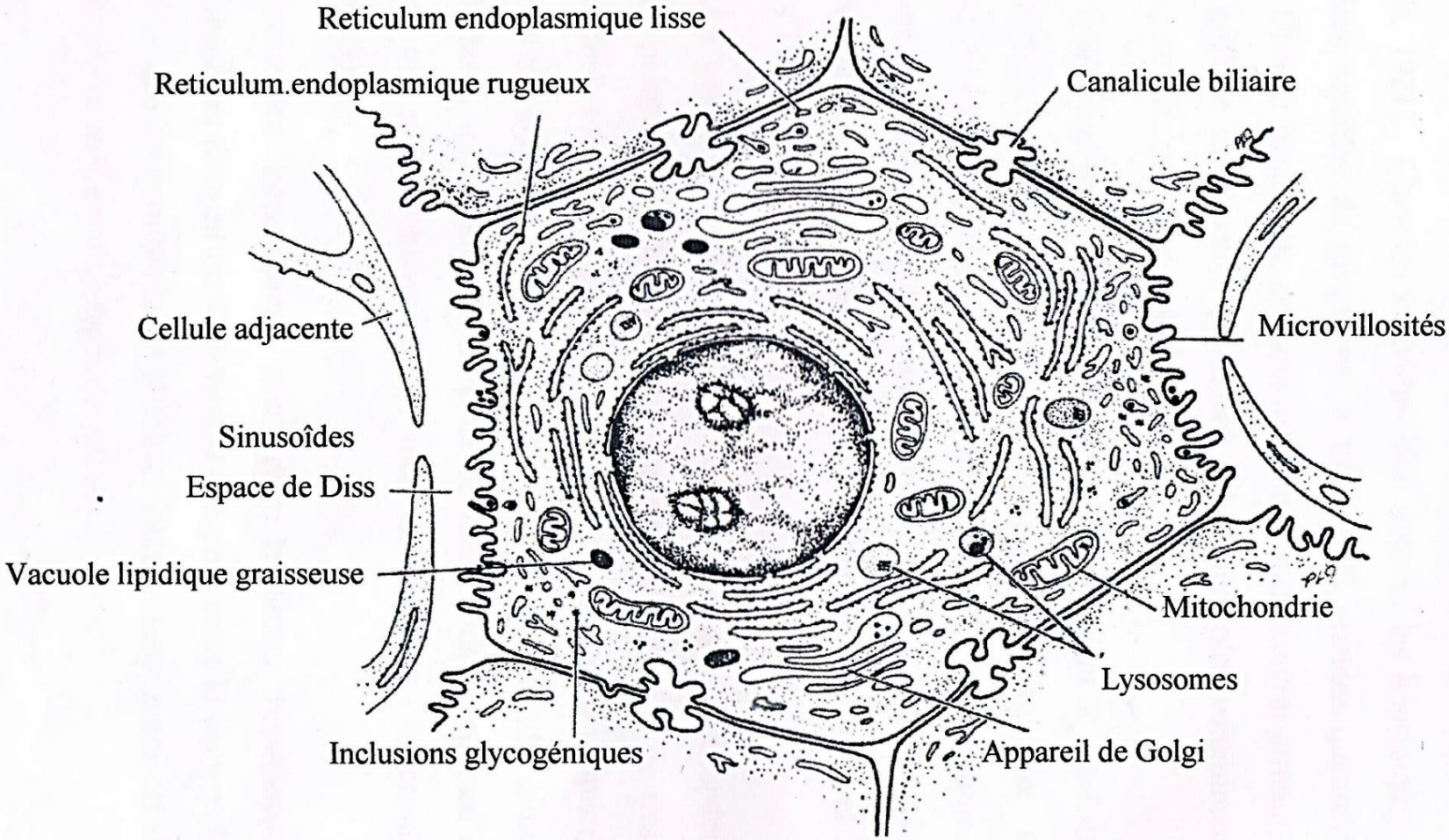


Schéma : Microscopie électronique de l'hépatocyte, des cellules adjacentes, des espaces de Diss et des sinusoïdes (d'après Banks, 1981)

- Typical non-contiguous endothelial cells that filter blood and endocytose small molecules.

- Large, star-shaped Küppfer cells are characterized by an activity important phagocytic activity (phagocytosis of pigments, breakdown products of blood cells) reds), and are involved in iron metabolism (Grau and Walter, 1971; Dessy Doise, 1992; Reith and Ross, 1965; Branca, 1921; Legrand and Carlier, 1986; Bacon and Niles, 1983).

- ITO (Fat-Storing Cell) cells , located in the Diss space, have no macrophage role, they are attributed a role in the storage of vitamin A (Dessy Doise, 1992).

II.3. The excretory ducts, the vessels and the nerves

II.3.1. Excretory ducts

The bile excretion pathways constitute a complex system comprising, firstly:

- Bile canaliculi: located in the hepatic trabeculae, they appear as Glandular lumens without their own walls. These are linear depressions hollowed out between two adjacent cells.

- Perilobular canals: lined with cuboidal epithelium, they rest on a lamina basal.

- The interlobular bile ducts: run through the portal spaces and join together further into the large extrahepatic bile ducts. All the ducts converge towards the hilum of the liver where they meet to form the hepatic duct: extrahepatic portion of the bile ducts (Grau and Walter, 1975; Polidard, 1944).

II.3.2. The lymphatics

They are located in the interlobular tissue, originating exclusively in the tissue connective tissue of the portal spaces and collect lymph coming from the interstitial spaces of the lobule. They never penetrate the thickness of the lobule; they originate at its periphery through... Capillaries of 15 to 20 µm. Some accompany the hepatic vein, others the portal vein (Grau and Walter, 1975; Policard, 1944; Branca 1921).

II.3.3. The nerves

They accompany the portal vein, form a plexus around the lobule, and penetrate the lobule where they terminate with free ends on the capillaries and on the cells hepatic (Branca, 1944).

II.4. Hepatic Circulation

The circulation of the liver is unique in that it originates from two sources: the portal vein provides 2/3 of the supply, with the hepatic artery providing the remaining 1/3.

II.4.1. Venous circulation

The portal vein, carrying venous blood from the intestines and spleen, accompanied Branches of the hepatic artery enter the liver at the hilum. These vessels... branch into interlobular veins and run between the lobules in the portal spaces, They surround the lobule, then penetrate it and branch out into fine capillaries: the sinusoids hepatic substances that drain into the centrilobular vein.

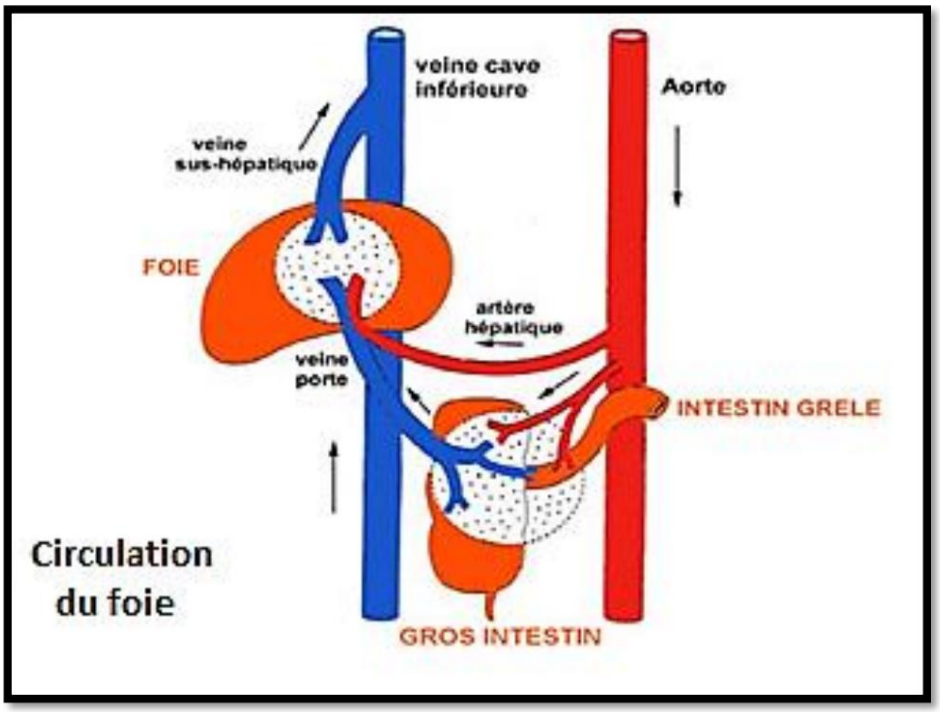
The centrilobular vein empties into a sublobular vein which runs between the lobules. The sublobular veins join together to form the hepatic veins, which terminate in the inferior vena cava (Dessy Doize, 1992; Swenson and Reece, 1993; Bevelander, 1973; Branca, 1921;).

II.4.2. Arterial circulation

Arterial circulation is ensured by the hepatic artery which, from the hilum... It branches into the portal spaces, following the branches of the portal vein. The function of the artery The liver's role is to supply nutrients to the various structures housed within the spaces door. To do this, branches of the hepatic artery divide into arterial capillaries. around the branches of the portal vein and the bile ducts.

The blood therefore reaches the lobule via the hepatic artery (nutritional system) and via the portal vein (functional system). But the two systems do not remain independent because the

The hepatic vein collects all the blood from the lobule, to transfer it to the vena cava inferior (Dessy Doize, 1992; ; Banks, 1981; Bevelander, 1973; Branca, 1921).

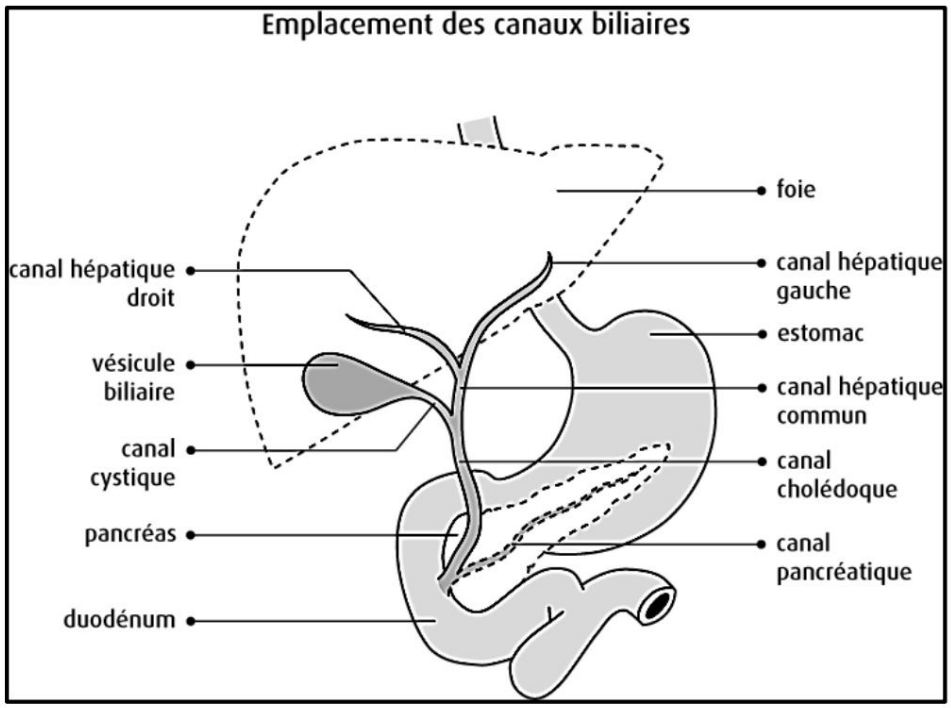


Note: The portal vein forms a capillary network that reassembles in the veins, whereas ordinarily it is an artery that constitutes the capillary network. This Circulatory disposition allows the liver to fulfill one of its functions, the storage of glycogen.

III. HISTOLOGY OF THE GALLBLADDER

The gallbladder is an ampullary structure located on the cystic duct; it accumulates The sphere is secreted continuously by the hepatocytes; it condenses the sphere by reabsorbing water and electrolytes. It expels the bile into the intestine.

The lower view of the liver allows us to see the gallbladder, this membranous reservoir greenish, located in the cystic fossa, presents the cystic duct, which connects it to the canal common bile duct.



The histological structure can be described in three zones.

III.1. The mucous membrane

It is covered with an epithelium that projects folds into the light which disappear with the refilling of this sac. This system of folds can cause deep invaginations reaching the mucous membrane and which could have been mistaken for glands.

The lining epithelium consists of tall columnar cells with a direct striated plateau at the apical pole corresponding to short microvilli less systematically oriented only in the enterocyte.

The basal pole of the cell is narrower; there are no goblet cells. The chorion

The underlying structure is characterized by an abundance of blood and lymphatic vessels; there is no of glands in this mucous membrane except at the level of the juxta-cystic zone where it secretes mucus.

III.2 The muscular

It is a thin, irregular system made up of smooth muscle fibers, the thin ones of which bundles of various orientations are separated by fibroelastic and vascular tissue.

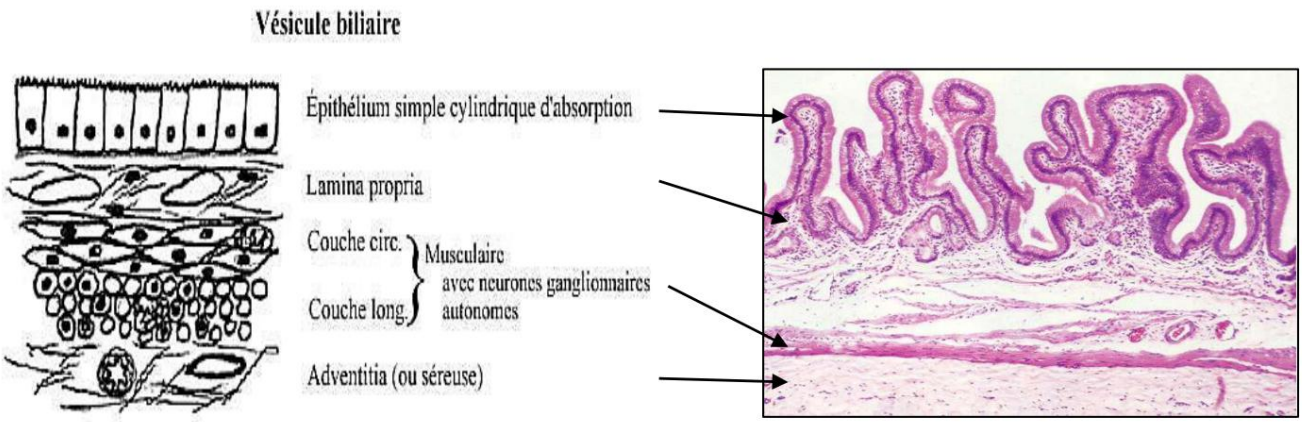
III.3 The adventitious

It is rich in blood and lymphatic vessels, nerve fiber bundles, and fibers

connective tissue, collagen, and elastics with fibroblasts and adipose cells. In the

In the area fused to the liver, the connective tissue continues with the interlobular connective tissue.

Elsewhere, it is lined externally by the peritoneum.



IV. HISTOLOGY OF THE PANCREAS

The pancreas is a mixed gland with both exocrine and endocrine functions. The pancreas

The exocrine secretes an alkaline fluid with a buffering role, rich in enzymes that gain the

The duodenum is released via the pancreatic duct (duct of Wirsung). The release of enzymes and alkaline fluid is

discontinuous and under the control of hormones secreted by the cells of the APUD system of

the surface epithelium of the digestive mucosa.

The endocrine pancreas is composed of cell clusters made up of richly endoplasmic reticulum

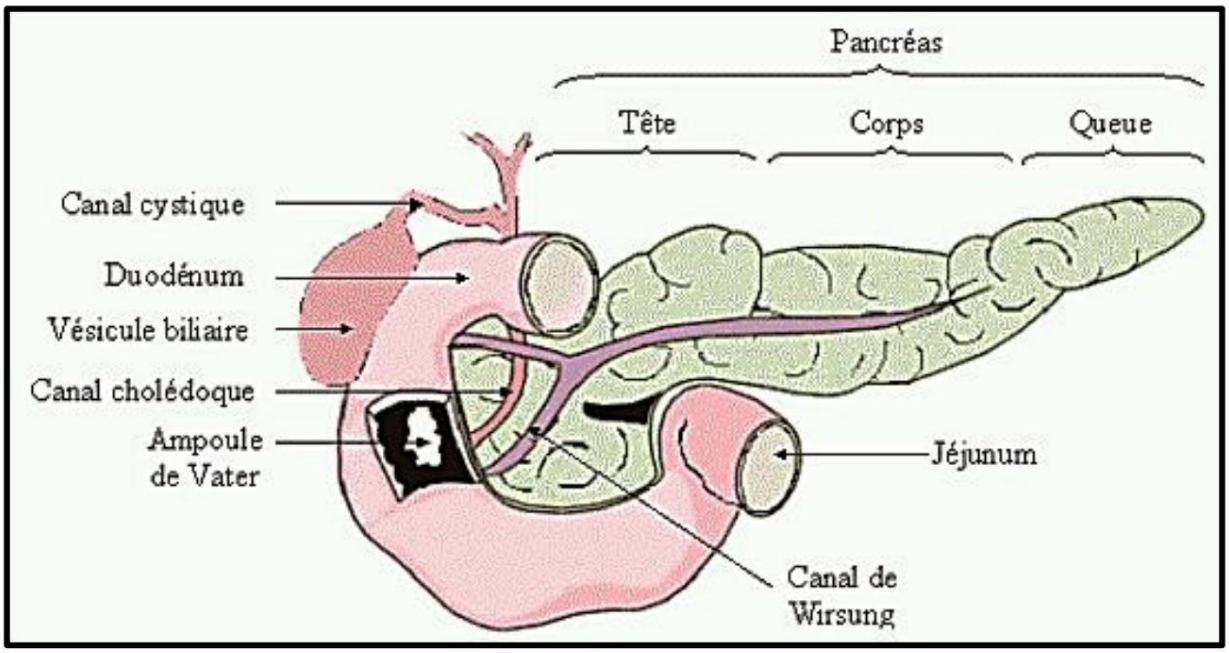
vascularized, endocrine cells, the islets of Langerhans.

The pancreas is a compound gland comprising two types of glandular tissue, exocrine and

endocrine.

The exocrine pancreas, which constitutes the major part of the tubuloalveolar gland with secretion serous. The gland is divided into lobules by connective tissue trabeculae. Each acinus is Composed of cells located in the center of the acinus, the centroacinar cells form the canals the smallest ones in the gland.

The endocrine pancreas is composed of small spherical clusters of cells, the islets of Langerhans. which contain numerous capillaries. These islets are randomly arranged within the acini pancreatic serous membranes.



IV.1 General Architecture

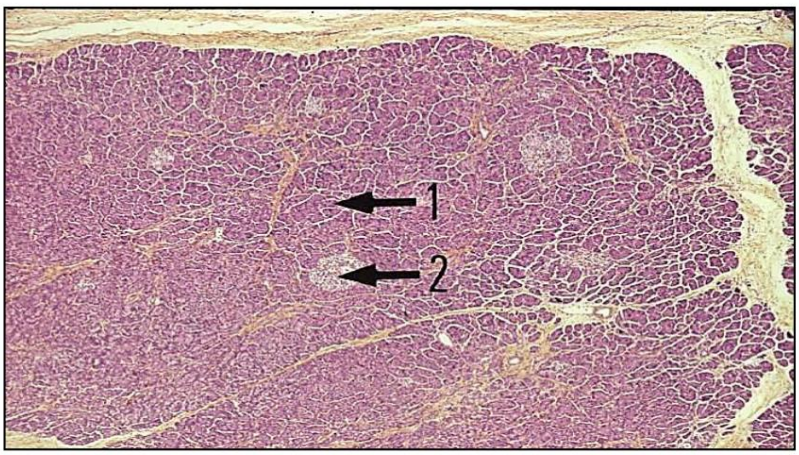
The pancreas is a lobulated gland enclosed by a thin, inconspicuous capsule connective tissue that emits within the slender connective tissue septa dividing the mass of Glandular parenchyma in wedge-shaped lobules. Dense connective tissue junctions The spaces between the lobules (extralobular junctions) contain the blood vessels. and lymphatics, the nerves and perilobular nerve plexuses whose elements originate from the celiac plexus. From these interlobular junctions arise septa which separate the lobules and send fine connective tissue fibers (of collagens and reticulin} with blood capillaries (there are no capillaries

lymphatic vessels in the lobules, the lymph circulates freely in the connective tissue spaces). These interlobular septa are rich in peracinar capillaries, adipocytes, and a few lymphoid points and loose connective tissue.

IV.2 Histological Structure

IV.2.1 The pancreatic lobule

It is formed from exocrine glandular tissue within which are found the islets of cells endocrine. Exocrine tissue, like pure serous glands, is composed of the juxtaposition of functional units which are the pancreatic acini pressed tightly against each other others. These acini are stalked by small excretory ducts, the intercalated ducts. homologous to Boll's passages (space formed by the intercalated duct of the salivary gland) of the parotid gland) and drain the secretory products into the intralobular ducts. These at In turn, they release the exocrine secretion of the lobule into the interlobular channels.



The pancreatic lobule : 1- exocrine portion of the pancreas, 2- islets of Langerhans

IV.2.2 Pancreatic acinus

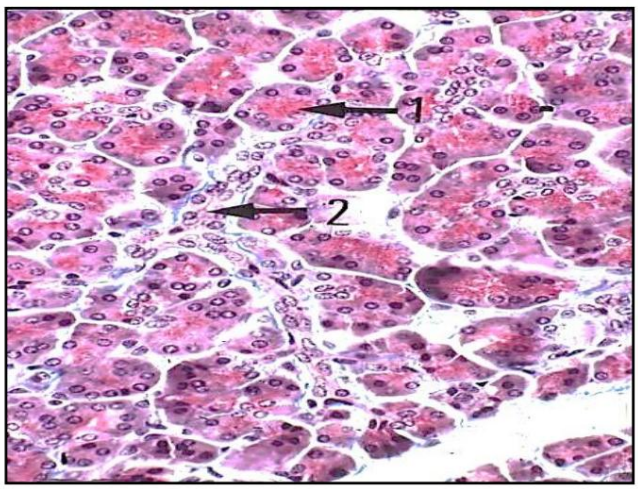
It has a rounded shape, often quite elongated, and is formed by a single layer of cells. pyramidal epithelial cells resting on a basal lamina without interposition of cells myoepithelial cells converging towards a central lumen.

Its size varies with the functional stage of the gland: small at rest and difficult to observe and it is distended by secretory products during periods of activity.

IV.2.2.1 Acinar cell

It is a typical serous cell whose characteristics indicate its intense activity elaborate. It has a pyramidal shape with a rounded apex that bulges discreetly into the light; its wider basal part rests on the basal membrane. It has a nucleus rounded and strongly nucleolated, the cytoplasm at their basal pole is relatively homogeneous. while at the apical pole it contains zymogen granules. These secretory granules characterizing this region, which is nuclear, and when they are very abundant, they come occupying the lateral regions of the nucleus, their size is on the order of 0.6 to 0.8 µm, they are rounded, dense, acidophilic, refractive, and varying in number with the functional stage of The cell, the zymogen granules are rich in proteolytic enzymes that act at various moments of protein catabolism, breaking them down in the small intestine.

Within the lumen of the pancreatic acinus are some special cells centroacinar cells that form the beginnings of the excretory ducts (the smallest of the gland) these drain into the intercalated ducts, then into the intralobular and inter lobular. The Wirsung duct receives the secretion from the interlobular ducts.



The pancreatic lobule: 1- acinus, 2- excretory duct.

IV.2.3 Centroacinar cells

They are either located in the lumen of the glandular cul-de-sac, flattened or fusiform elongated parallel to the long axis of the acinus, they emit filiform extensions which penetrate between the acinar cells and even implant themselves on the basal lamina and extending the intercalated ducts into the secretory cavity without reaching the bottom of These ones. They are clear and homogeneous; their nucleus lacks a nucleolus but is charged fine chromatin granules. Centroacinar cells are recognizable on the one hand by their location and on the other hand by the pale appearance of their core.

IV.2.4 The excretory ducts

IV.2.4.1 Intercalated canals : these peduncle the acini; they are the counterparts of the passage of Boll of the serous salivary gland, they are very fine. These ducts continue in the lumen of the acinus in the form of centro-acinar cells.

IV.2.4.2 Intralobular ducts : are formed of a low cuboidal epithelium which rests on a basement membrane. They are much rarer than in salivary serous glands.

IV.2.4.3 Interlobular ducts : have a cuboidal epithelium and their caliber is more important than that of the previous ones.

IV.2.4.4 The main excretory ducts: receive the drained processing products by the previous ones.

The pancreas communicates with the duodenum via a wide duct and a narrower duct (which often throws itself into the first one before reaching the intestinal opening).

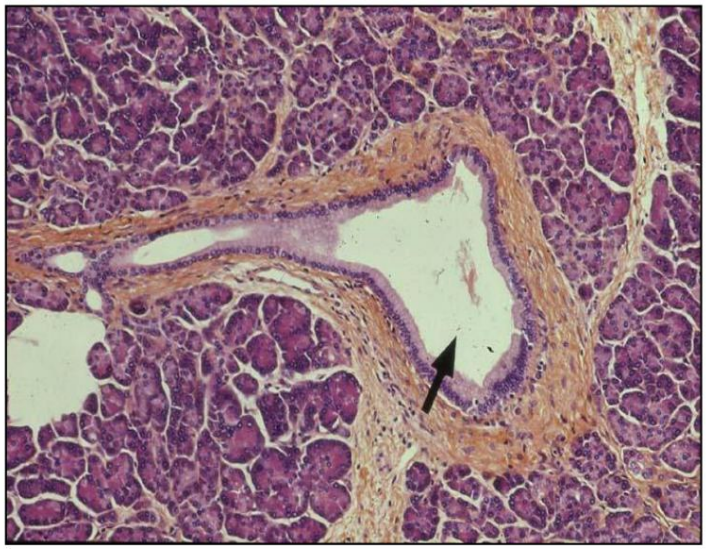
- **The Wirsung Canal**

It begins at the level of the pancreas and along its path receives numerous branches accessories (interlobular) thus increasing in size as it approaches the duodenum.

• **The accessory conduit**

This is the Santorini canal, approximately 6cm in diameter, located above the previous one, and it flows into This one, more rarely, opens in isolation into the duodenum.

These main excretory ducts are lined by a columnar epithelium, often with single-layered striated plate in which goblet cells and chromosomes can be found argentaffin (intestinal endodermal origin).



The excretory ducts

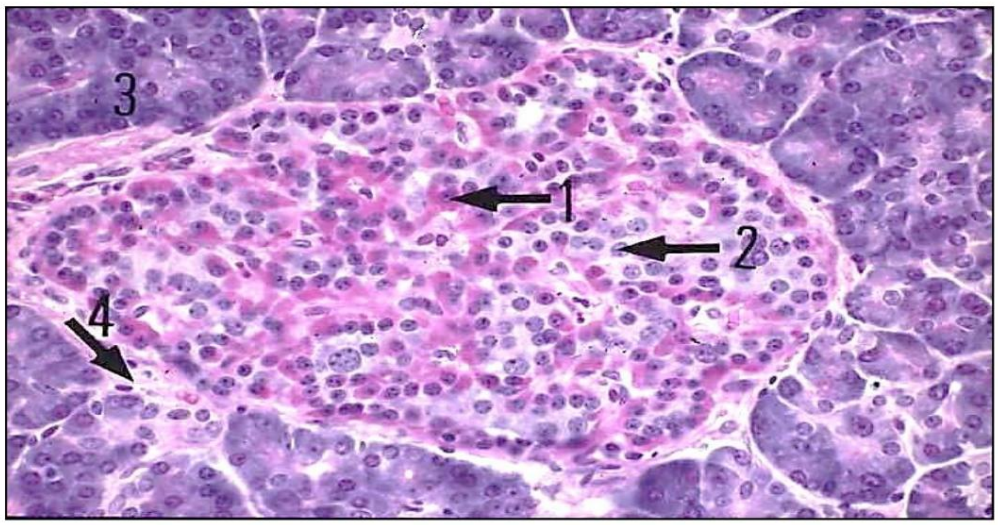
IV.2.5 The Langerhans islets

These are large, rounded cell clusters of 200 to 300 µm disseminated between the acini serous and richly vascularized and surrounded by reticulin fibers.

The islets of Langerhans contain 5 types of cells that can only be distinguished by... Special colorings include:

- ÿ **or (A) cells** secreting glucagon (increase blood glucose).
- **B cells or (B)** which synthesize insulin (lower blood glucose).
- **G cells** producing gastrin (stimulate the secretion of HCl by the parietal cells of the stomach).
- ÿ **or (D) cells** that secrete somatostatin, which inhibits the section hormones are released by neighboring cells.

- **PP cells** secrete the pancreatic peptide which inhibits the secretions of exocrine pancreas. The islets of Langerhans vary in size and number depending on the various parts of the gland and individuals
- **B cells** (65-80%): these are the most numerous and recognizable to the presence of secretory granules whose dense center is surrounded by a zone clear.



The islets of Langerhans: 1-alpha cells 2-beta cells, 3-exocrine portion, 4- connective tissue capsule.