



Lec 1

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- * All living organisms have Digestive system (in different structures may be simple or complicated system).
- * So they take food then processing it to make it more simple units to be absorbed. then they be used as building blocks or source of energy. Finally to be eliminated.
- * **Ameba** (unicellular microorganism) → not called Digestive system. So simple [uptake a vacuole → processing → eliminated from another vacuole outside]
- * **Spong**: is a (unicellular organism) So cells have Flagella to move water (water flow) pass between cilia or plasma membrane extensions and the particles uptaken.
- * **hydra**: (بشيرة متفصصة) contain a tube and extensions that take smaller microorganism (food) to be digested and eliminated from the same opening (anus and mouth are the same structures.)



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(نوع من الديدان)

* The separate opening of GIT system appear in

Nematode : it contain opening called mouth and tube like structure called intestine and another opening called anus.

* In more developed worms the intestine tube become swallowed at some area (to increase the efficacy)

* As the organisms developed the Accessory organs of the Digestive system appear



Till we reach

The most complex and most developed and effective Digest system



The Digestive system in humans

There's aggregations of immune cells
So
Is a barrier between the internal and external environment.

The Function of Digestive system:

1. uptake food
2. Digestion
3. absorption
4. elimination



The Digestive tract function:

1. Ingestion = uptake food
2. Mastication = break into simple units
3. Motility
4. Secretion
 - ← exocrine secretion
5. Hormone secretion → endocrine secretion
6. Chemical Digestion by enzymes
7. Absorption
8. Elimination

The Digestive system is a hollow tube from mouth to anus and contain

4 Layers: Mucosa^①, Submucosa^②, Muscularis^③ & Propria^④

Most inner Layer

muscularis externa

well developed thick maybe a double Layer

move the contents of the Digestive system

④ serosa or adventitia

(according to the site)

In Small intestine: its mucosa contain foldings called

Circular plicae (semi-circular)

it increase the area of absorption

between mucosa and submucosa there's the muscularis interna (muscularis mucosa) which is thin layer of smooth muscle cells separate the mucosa from the submucosa its contraction lead to the adaption of the mucosa with its function.



* Muscularis propria in most

Sites it's a 2 Layers

1. internal circular

2. External Longitudinal

except in stomachs there're 3 Layers

↳ Int.

• Serosa or adventitia:



During the embryology the abdominal cavity lined by layer of mesothelial cells

(1 Layer of epithelial and C.T. Layer under it)

The Digestive tube from post. part start developing and ↑ size and then it move to the middle of the abdominal cavity with the its mesothelial layer and its blood supply

visceral parietal > Peritonium

The tube is surrounded by mesothelial layer and the 2 layers that met called Mesentery (contain blood vessels and lymphatics)

* Some organs there's No serosa (They still in post abdominal part retroperitoneal)



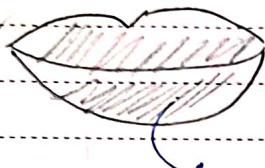
Oral Cavity:-

- ① hair follicles
- ② sebaceous glands
- ③ eccrine glands

A. Lips:-

① surrounded by ~~mucosa~~ skin

② The separating line between the upper and lower lip is the separating structure between lips and (internal oral mucosa)



③

vermilion

contains

- 1. minor salivary glands
- 2. sebaceous gland

no eccrine glands or salivary glands

* all The structures lined by stratified squamous epithelium.

* vermilion and skin → keratinizing

* moist oral mucosa → non keratinizing

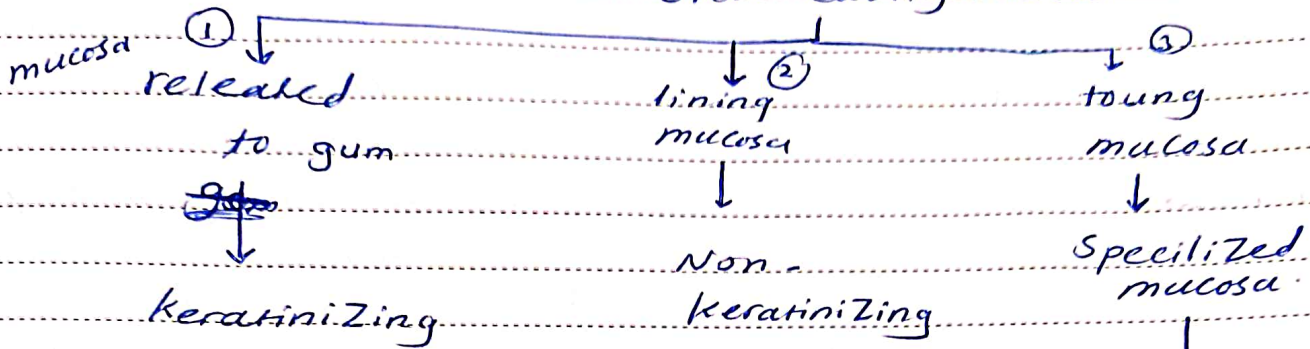
In mucosal part the squamous epithelium is thicker than in skin

* In lower lip there's a striated muscle cells (help in lip movement) ^{to speak} _{eat}



B. Oral Cavity → lined by stratified squamous epithelium

Oral Cavity areas



Structures

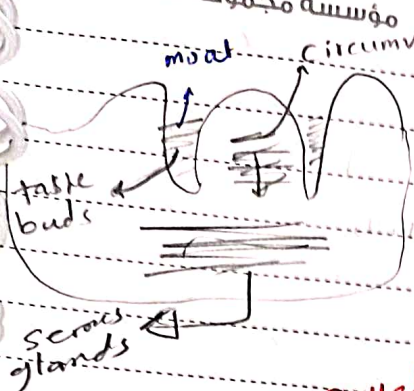
1. Terminal Sulcus
2. Lingual Tonsils (in most Post. part)
3. Filiform papillae (C.T. upward

The Fungiform imbedded inside the Filiform

have only a mechanical role. No taste buds. heavily Keratinized Stratified Squamous epithelium.)

4. Fungiform papillae: it's a mushroom-like structure lined by stratified squamous epithelium and contain taste buds. They located at the dorsal surface of filiform papillae.

5. Foliate papillae: ridge like structure on the lateral borders



6. Circumvallate Papillae:

- The large, dome shaped
- Anterior to sulcus terminalis
- The tongue has 8 to 12 of them
- Surrounded by moat like structure
- Contain taste buds
- Under it there's a serous glands they empty their secretion in the moat structure

(Von Ebner's glands)

The secretion flushes material from moat to enable the taste buds to respond rapidly to changing stimuli

Taste buds:- is an onion like structure

Contain
3
cell
types

- Contain a small opening onto the epithelial surface at the apex of the taste buds is called taste pore

1. Sensory cell (modified cell)
= for taste sense
kind by nerve to brain

2. Supporting cells to support the sensory cells

3. Basal cell • stem cell
• generate the taste buds

Esophagus:-

- tube that deliver food from pharynx to stomach

irregular c.T + rich in blood supply

Contains: mucosa
Submucosa
muscularis propria
adventitia

Mucosa: • Non-Keratinizing Stratified Squamous epithelium

S.S.p. → is Thicker than in stomach
(س.س.ب. ← هو أرق من المعدة)
Submucosa (الموجود تحت المكونة)

in all structures:

Mucosa:

Contains

1. epithelium and its basement membrane
2. lamina propria (c.T rich in blood vessels)
3. Thin double layer of smooth muscle cell

• in esophagus submucosa there's a mucous glands to lubricate

• muscularis propria → 2 muscle layer
inner circular and outer longitudinal



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(GIT has its own brain)

↓
2 nerve plexuses present in GIT.

[1]

submucosal plexus
" Meissner's plexus

[2]

intramucosal
myenteric
Auerbach's

Esophagus has adventitia there's no
peritonium and it's directly attached
to the surrounding organ by C.T.



That lead in the esophageal
cancer is more aggressive than
other structures. So if it reach
the adventitia it will reach
the other organ attached with it
by the C.T. (adventitia)

Stomach:

Structures: 1. gastroesophageal
Junction

2. Funds

3. body

Funnel shape ← 4. pyloric antrum

5. pylorus



Gastric Mucosa:

- A. Cardiac mucosa surrounding the gastroesophageal junction
- B. Pyloric mucosa in the pylorus
- C. Fundic mucosa in funds + body

↓
secrete
mucose
to
protect
most
distal
part

↓
• have a numerous opening
called gastric pits or foveolae

• The glands of the stomach
open into the bottom of the
gastric pits.

• may one gastric pit
canation 2 or 3 glands
open in it.

* glands of the stomach are
tubular (mainly branched one or
2 single tubule)

* Surface epithelium play a role
in protect the stomach from some
enzymes that contains as pepsin

* Stomach contain a longitudinal
foldings in its mucosa called Rugae
to help the stomach to expand



Columnar cells + mucos granule + Flatted nucleus (cytoplasm filled with nucleolus) + golgi apparatus + RER + apparatus below part

- Surface epithelium secrete mucus (rich in bicarbonate to balance the stomach acidity)

- renewal of surface epithelium is very high (if it damaged it easily repaired)

isthmus → short segment between gastric pit and glands (جزء الغدة بين الفتحة)

rich in stem cell

migrate upward to become mucose surface in the gastric pits

migrate downward to maintain the population of Fundic gland epithelium

- The point of glands that meet the isthmus called neck segment (lined by neck cells that secrete mucus)

pink color

parietal cells present in neck and isthmus dispersed among other type of cells in up or down part. it produces Hcl and intrinsic factors (responsible of B_{12} absorption)

Columnar bluish cell + rich in RER

Chief cells (in the most deep part of the gland) produce pepsinogen (Pre-cursor of pepsin). contain Zymogen producing cell → enzyme precursors



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Parietal cells have an extensive intracellular canaliculus system that communicates with the lumen of the gland also it has an extension of plasma membrane to increase the effective area

around the intracellular canaliculus system there's a tubulovesicular membrane system is a reservoir of plasma membrane containing active proton pumps that produce H^+ (acid)

↓ when acid production signal reach

This membrane material can be inserted into the plasma membrane of the canaliculi to increase their surface area and the number of proton pumps available for acid production

parietal cells rich in mitochondria

for GIT

Exocrine cells: hormone or substance producing cells into the blood vessels or paracrine

Endocrine cells

Not in GIT just it presents in many system previously it called (APUD) But now it called (DNES)

it regulates the motility and secretion and other functions of the Digestive system



• DNEs may be **closed** or **open**

↓

apical of the cell exposed to the gland lumen

↓

It has a chemoreceptor that sample the contents of the gland lumen and release the hormone based on the information obtained from those samples.

↓

gland lumen

↓

don't always reach the gland lumen

↓

Hormone that secret by it affect the surrounding environment or if there's a blood vessels (systemic effect)

• Deep part of glands may reach the muscularis mucosa

• **Stomach sub mucosa**: is an irregular dense C.T rich in blood vessels and lymph.

• **Lamina propria**: loose C.T between the glands and in the space between basement membrane and muscularis mucosa

• **muscularis propria** in stomach ^{is} 3 layers

(1) most inner oblique | (3) most outer longitudinal

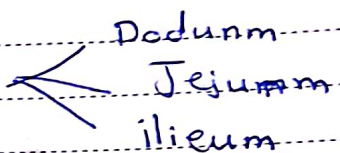
(2) Middle circular



Pyloric Sphincter: Prominence of muscularis propria that separate the stomach and duodenum.

Serosa: Mesothelial layer underlying by thin C.T layer.

Small intestine :-

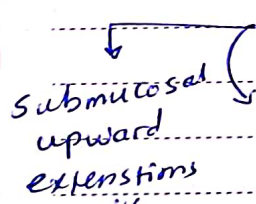
* Separated into 3 parts 

* Duodenum - 25 cm long (shortest)

* Small intestine mucosa different from gastric mucosa

* " " " " contain

plicae circulares [transverse folding not full circumferential]

↑ Surface area  → ↑ absorption efficacy

submucosal
upward
extensions

muscularis
mucosa

↑ its inner
surface

forms
villi

* Small intestine mucosa contain finger like projections (↑ Surface area → ↑ absorption)
= villi

* Crypts of Lieberkühn are simple tubular structure that extends from the muscularis mucosa through the thickness of lamina propria and they open in luminal surface of villi.



The surface

of villi lined by enterocytes

- The core of the villus contain branch of arterial system and branch of venous system and blind ending of the lymphatic system called Lacteal

at the apical surface

is

a plasma membrane extensions

- The narrow openings in the villi are the crypts of Lieberkühn

- Microvilli of the enterocytes provide the major amplification of the luminal surface.

- Villi by light microscope is a brush border

* Peptidase

(from Polypeptide to amine acids)

- glycocalyx: rich in Final step Digestive enzymes

electron Microscope

mucin-secreting glands

- Goblet cells:
 - 1) between enterocytes
 - 2) Compressed down against the basal part
 - 3) Filled by mucus

- Paneth cells: function in immune system (antimicrobial substances)



Enteroendocrine cells: produce
paracrine and
endocrine hormone

① B, T lymphocyte
② Macrophage
③ Dendritic cells

contain

M cells (Microfold cell):

located in the epithelium that
covers lymphatic nodules in the
lamina propria.

Apical Surface of M cell
Detect the microbiology of GIT
(regulate the GIT normal flora)

normal flora

first cms

in! duodenum there's a primary
gland (mucus secretion gland) + (rich
in bicarbonate)

Large intestine?

Cecum → Ascending Colon → Transverse Colon → Descending Colon

anal canal ← rectum ← Sigmoid Colon

large intestine mucosa: surface epithelium
and tube like
structures (crypts)

lining for crypt epithelium → rich in goblet cells.



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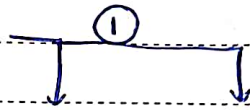
cells of Large intestine

- Columnar absorptive cells
 - Colonocyte
 - goblet cell
 - Stem cell
 - DNEs
- esinophilic between goblet cell

+ lamina propria contain MALT

Appendix:

- blind tubular structure
- its structure similar to colon with 2 different



muscularis
Propria

muscularis
Propria

Large
intestine

inner circular

inner circular

and the

outer longitudinal

not at all circumference

they are 3 bands

Called **Teniae**

outer longitudinal
diffusely dispersed
not in bands

②

MALT is rich in appendix
more than large intestine.

* **Anal Canal:** upper border of pelvic diaphragm
to the anal opening.



Dentate line: mucosa at the end of the rectum make longitudinal foldings called anal columns between each anal colon and other there's a anal sinus at the end of the structure there's a Ziq Zag line called

Anal Canal 3 Zones:

- from dentate line distally → Squamous Zone
lined by stratified squamous epithelium

- Colorectal Zone: Structure similar to rectum / upper third of anal canal

- anal Transitional Zone:

↳ Transition between squamous and cryptic epithelium

↳ Mid third of anal canal

↳ from Dentate line

↳ length 1. or 1.5 cm