

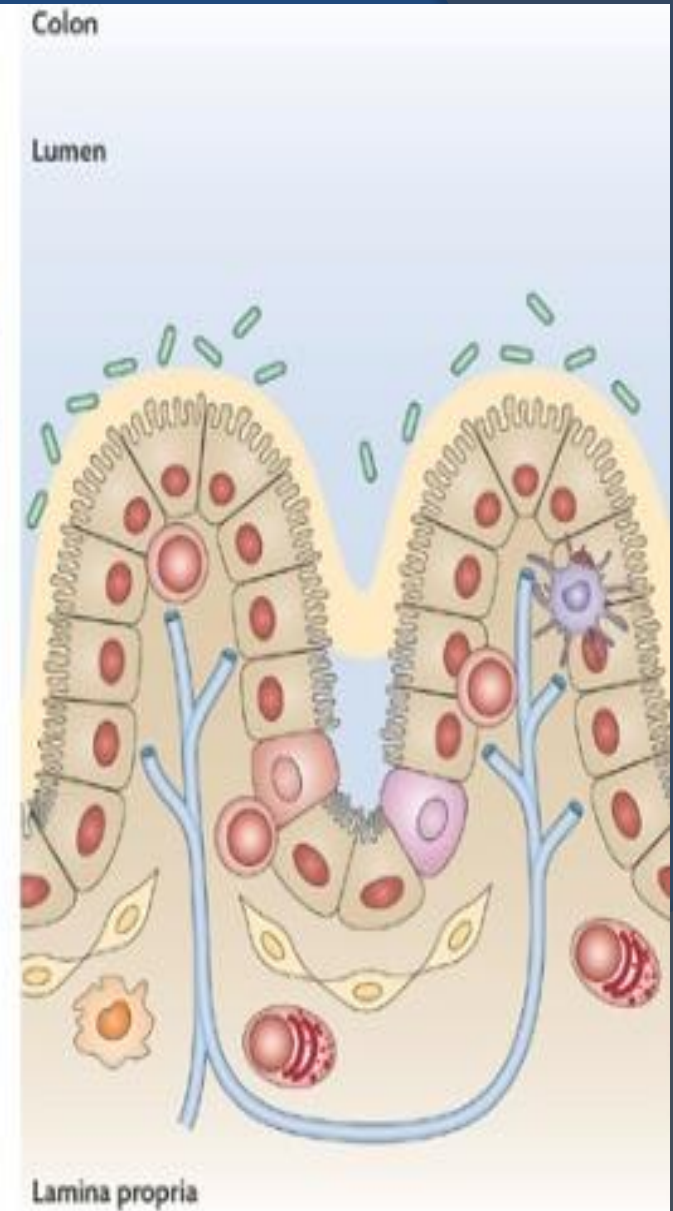
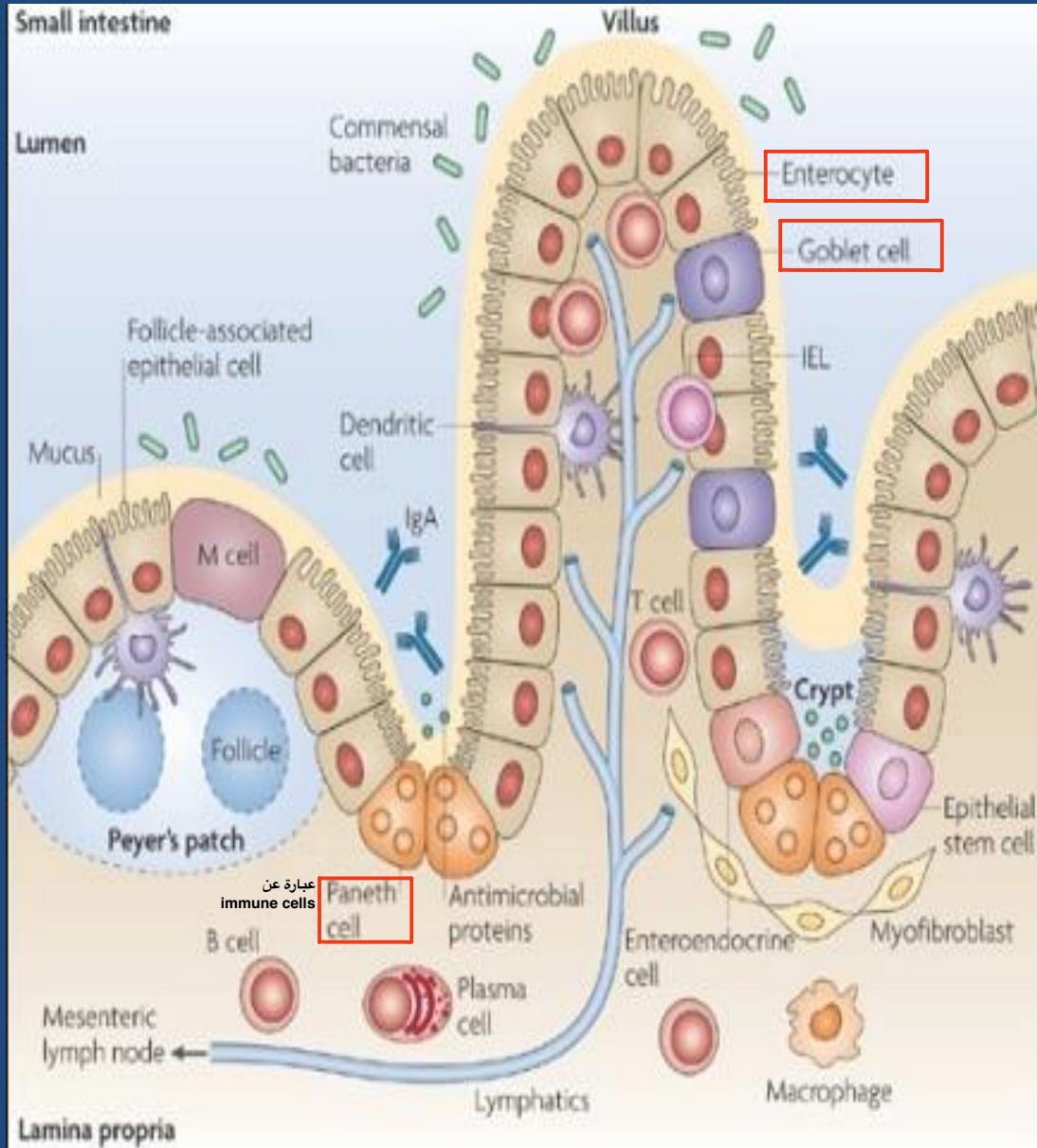
SECRETORY FUNCTION OF GIT

صَلِّ عَلَى النَّبِيِّ

- **Secretory glands** produce digestive enzymes present from mouth to terminal ileum. عشان هيك موجودين في المنطقة الي بصير فيها digestion of food تبدأ من ال mouth وبتنتهي في ال terminal ileum، فش serectory enzymes digestion in the colon، عشان هيك فش digestion in the colon
- **Mucus glands** lubricants from mouth to anus. موجودة في كل ال GIT، من ال mouth لل anus

1. Enterocytes
2. Goblet cells
3. Paneth cells
4. Mast cells

ال Vili فيها four types pf cell



Anatomical type of glands

لأنها عاملة زي ال glass، زي الكأس

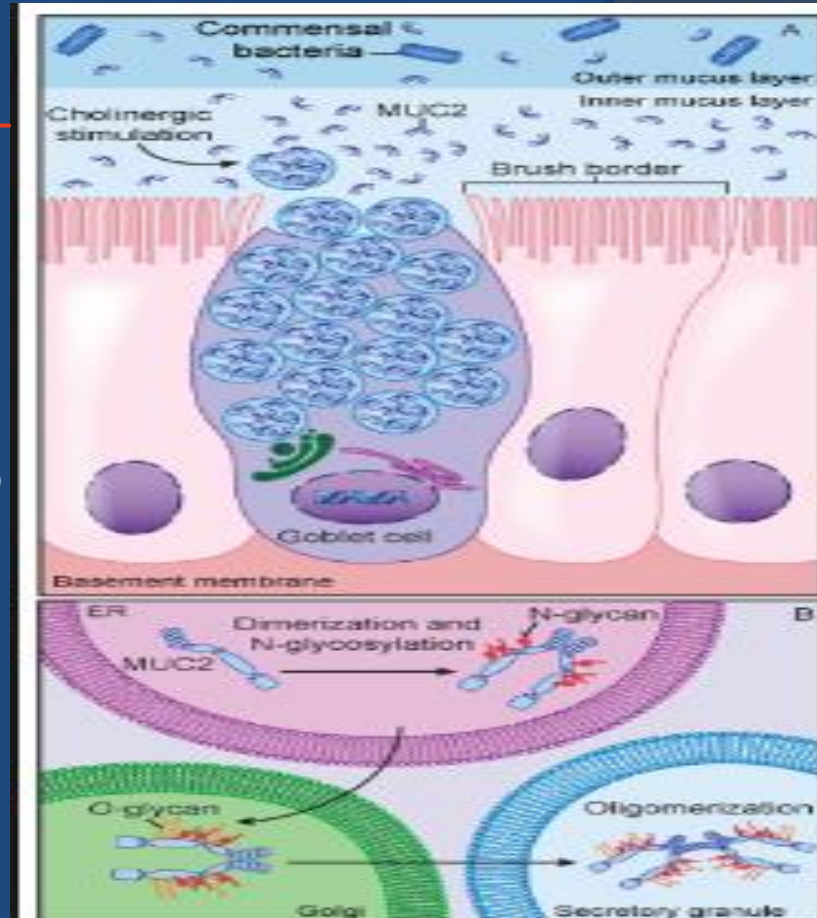
- Goblet cells single mucus secretion gland.

- Specialized glands lie in pits like crypts of Lieberkühn. زي ال Parietal cells الي بتفرز ال HCL، وفي ال chief cells secrete pepsinogen

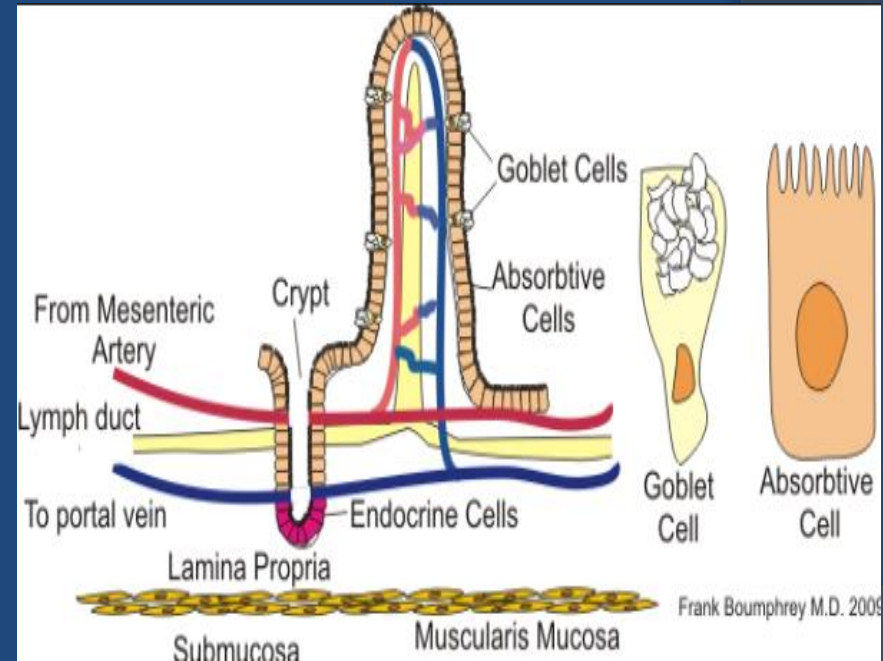
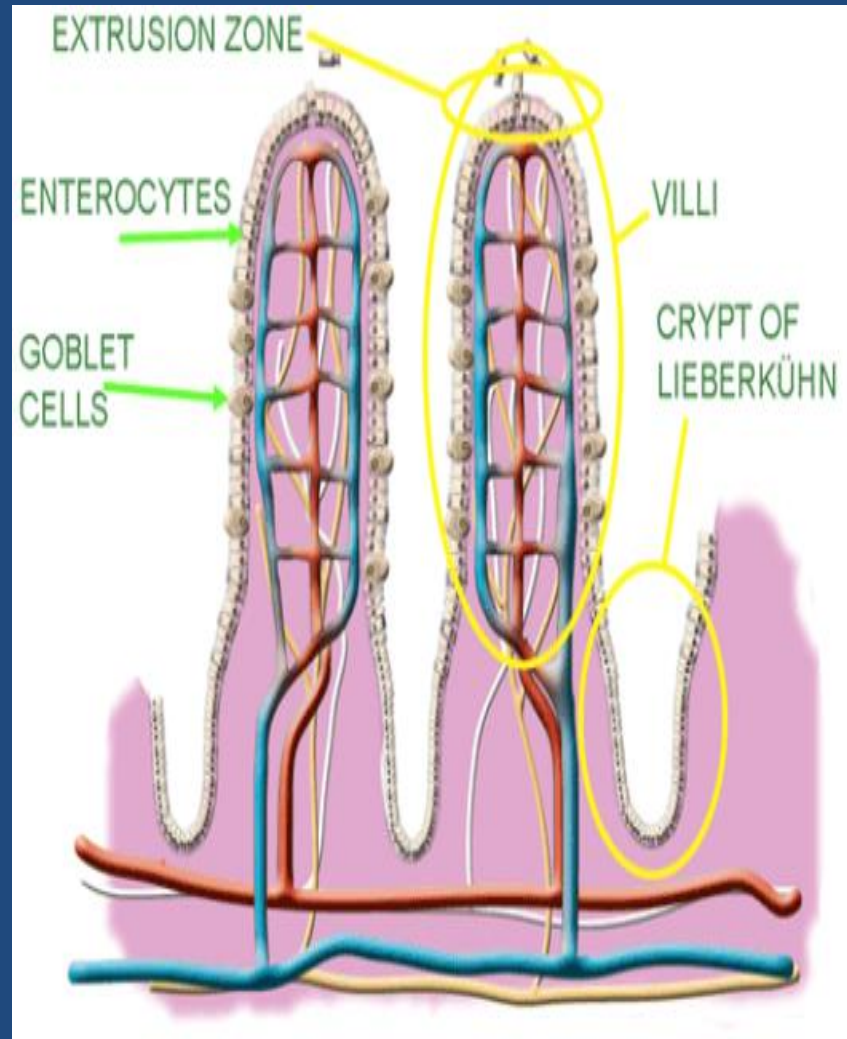
- Deep tubular glands oxyntic cells.

- Several complex glands salivary ,pancreas liver.

- Complex glands are a type of exocrine gland that have branched ducts. This means that the main duct that carries the secretion to the surface divides into multiple smaller ducts, and the secretory units (the cells that produce the secretion) are located at the ends of these branches.



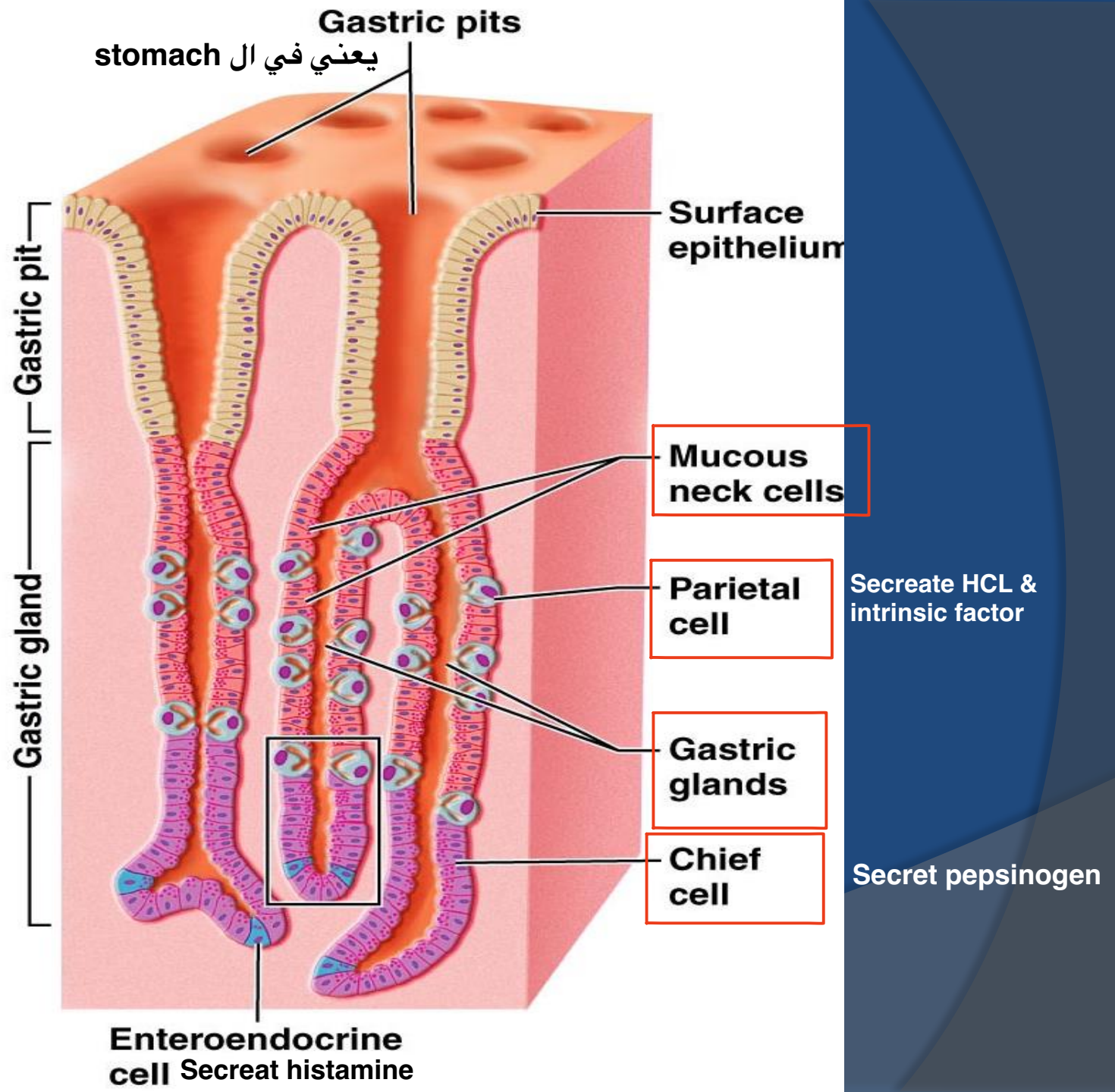
- Enterocytes هي ال cells الأساسية في ال intestine، الي بتعمل secretion و absorption
- وفي عنا goblet cells الي بتفرز ال mucous
- وفي عنا ال Enteroendocrine cells الي بتفرز ال Histamine
- وفي ال paneth cells



- Enteroendocrine cells are specialized hormone-secreting cells found throughout the lining of the gastrointestinal (GI) tract.

✓ Major Hormones Secreted by Enteroendocrine Cells:

Cell Type	Hormone Secreted
G cells	Gastrin
I cells	Cholecystokinin (CCK)
S cells	Secretin
K cells	GIP (Gastric Inhibitory Peptide)
L cells	GLP-1 (Glucagon-like peptide-1), PYY
Enterochromaffin (EC) cells	Serotonin (5-HT)
Enterochromaffin-like (ECL) cells	Histamine



Basic mechanism of stimulation of alimentary tract glands

- Mechanical stimulation by presence of food especially mucus gland Direct contact أهم اشئي
- Function of Enteric Nervous Stimuli ال mini brain يعني
 - Tactile stimulation. in contact يعني
 - Chemical irritation. secretions او الأكل الي مأكله بزود ال
 - Distention of the gut wall.
- Autonomic Stimulation of Secretion
- Parasympathetic Stimulation. secretions عادة بزود ال
- sympathetic Stimulation. secretions عادة بقلل ال
- Regulation of Glandular Secretion by Hormones
- Chemically, the gastrointestinal hormones are polypeptides or polypeptide derivatives.
small intestine في ال CCK وال gastrin hormone في ال stomach زي ال secretin وال

Importance of Mucus in the Gastrointestinal Tract

- Mucus is a thick secretion composed mainly of
- **Water, Electrolytes, Mixture of several glycoproteins,** (large polysaccharides bound with much smaller quantities of protein).
 - واحد عنده diarrhea وبطلع ، بما إنه rich in electrolytes ، a lot of mucous
وأهم اشي ال K، فبوطى عنده ال K (زي حالات ال ulcerative colitis)، وحكيها
كمان انه rich in proteins، يبقى احتمال يصير معك hypoproteinemia
- Mucus is slightly different in different parts of the gastro-intestinal tract.
- But everywhere it has several important characteristics that make it both an excellent **Lubricant and a Protectant** for the wall of the gut.
 - ال mucous in the stomach الي بنسميها ال viscid gel layer بتعمل افراز لشوية alkali، عشان ما يصيرش digestion لل mucous glands of the cell of the stomach
(ال viscid gel layer تعتبر physical barrier، وال alkali تعتبر chemical barrier)، لو صار اختراق لل gastric ulcer يصير mucous layer

- Mucus has Adherent qualities that make it adhere tightly to the food or other particles and to spread as a thin film over the surfaces.
- It has Sufficient body that it coats the wall of the gut and prevents actual contact of most food particles with the mucosa.
- Mucus has a low resistance for slippage, so that the particles can slide along the epithelium with great ease.
- Mucus causes fecal particles to adhere to one another to form the feces that are expelled during a bowel movement.
- Mucus is Strongly resistant to digestion by the gastrointestinal enzymes.
- The glycoprotein of mucus have amphoteric properties, which means that they are capable of **Buffering** small amounts of either acids or alkalis.
- Also, mucus often contains moderate quantities of bicarbonate ions which specifically Neutralize acids.

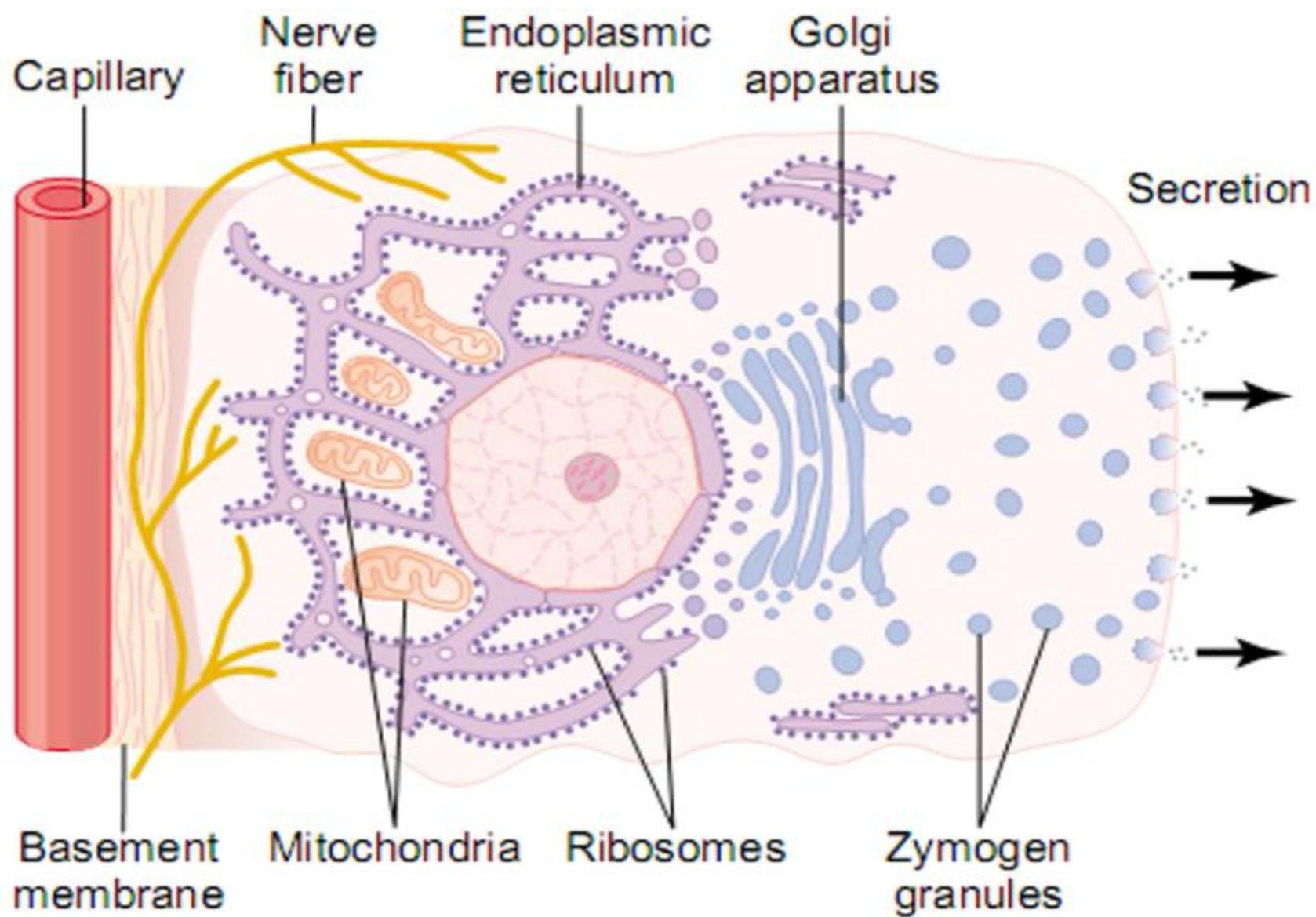


Figure 64-1

Composition of gastrointestinal secretions

حكيثا 7-8 liter/day وبتدخل لآرين؁ يعنى 10L

لآر إسهاال كم ملي مول
صوآيوم فيه؟ 140

Type of secretion	Volume	Na ⁺ Per liter	K ⁺ Per liter	Cl ⁻ Per liter	Hco ₃ ⁻ Per liter
			rich in K أهم صفة فيه أنه K		rich in.. وكمان
Salivary	1000 1-1.5L	20	<u>26</u>	50	<u>50</u>
Stomach	1500 1.5-2.5L/day	70 نص ال Na الموجود في ال plasma	10	100	0
Small bowel	2500	140 زى الـ في ال plasma	<u>20</u>	104	30
Bile	1000 750-1000	140 زى الـ في ال plasma	5	100	35
Pancreas	1000 750-1000	140 زى الـ في ال plasma	5	70	<u>115</u>

Chemical composition of body fluids

Fluid	Na	K	Mg	Hco3	Protein	PO4	CL
Intracellular أكثر حاجة positive charge هو ال K وال Mg أما ال anions ال phosphate وال protein	10	150 Main positive charge	40	10	40	120	3
Interstitial	144	4	2	30	1	3	114
Plasma أكثر حاجة positive charge هو ال Na أما ال anions ال CL وال Hco3	142	4	3	27	16	3	103
Ringer lactate المحلول الي يشتعمله في ال GIT loses، وذلك لأنه أكثر نوع من المحاليل قريب لل plasma	130	4	-	28	-	-	109

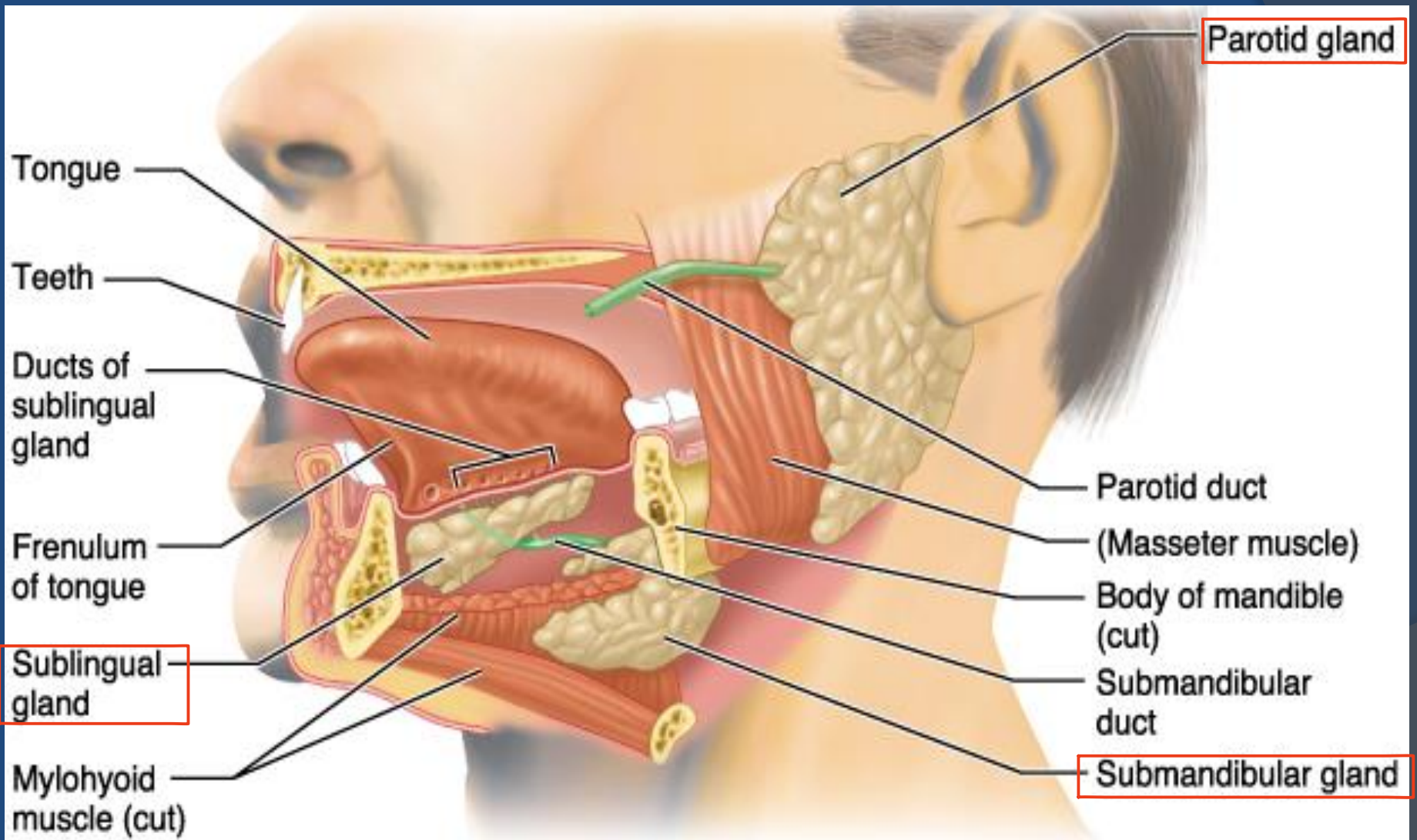
2-Secretion of Saliva

Daily Secretion of Intestinal Juices

	Daily Volume (ml)	pH
Saliva	1000	6.0–7.0
Gastric secretion	1500	1.0–3.5
Pancreatic secretion	1000	8.0–8.3
Bile	1000	7.8
Small intestine secretion	1800	7.5–8.0
Brunner's gland secretion	200	8.0–8.9
Large intestinal secretion	200	7.5–8.0
Total	6700	

- Saliva Contains a Serous Secretion and a Mucus Secretion
- The principal glands of salivation are the
- Parotid: Serous type of secretion
- Submandibular: Serous secretion and Mucus (70)%
- Sublingual :serous secretion and mucus.
- Buccal glands: only mucus كثير عددها، يمكن حوالي 300
- Daily secretion of saliva normally ranges between 800 and 1500 milliliters, as shown by the average value of 1000 milliliters

secretions معظم ال at rest
بتطلع من ال Submandibular



Parotid salivary gland

Parotid duct

Masseter muscle

Mucosa (cut)

Sublingual ducts

Submandibular duct

Sublingual salivary gland

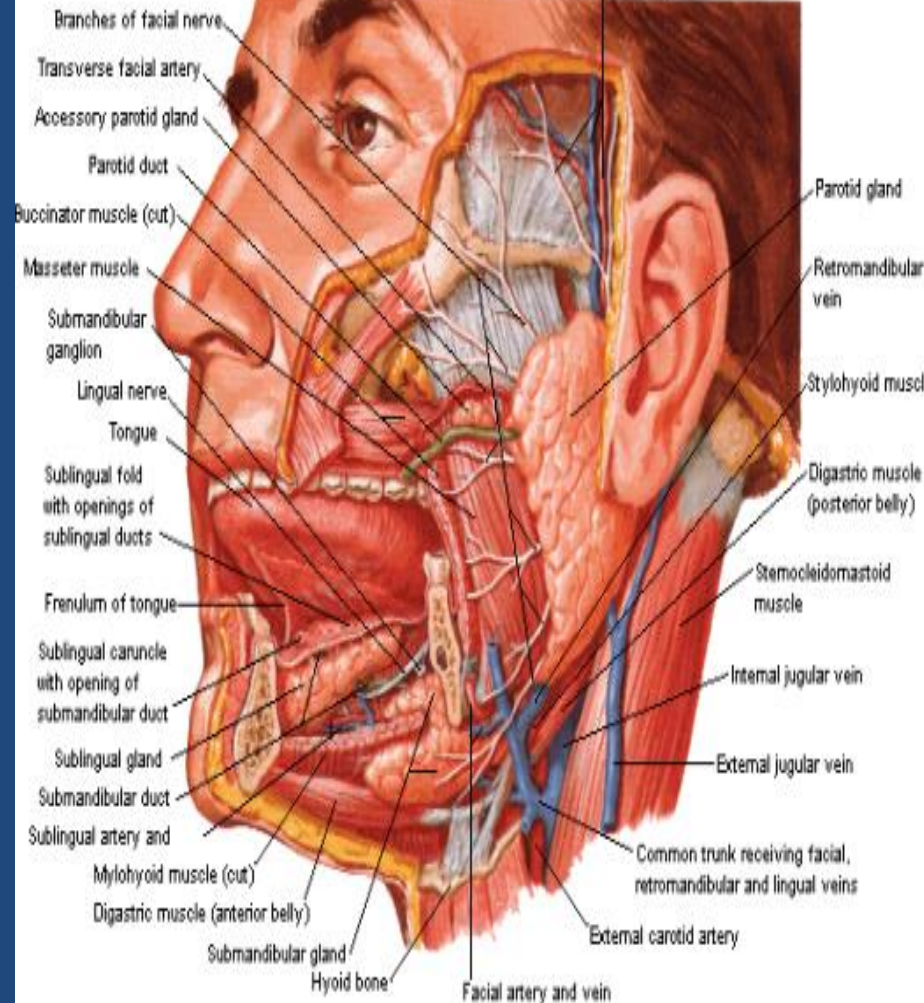
Mylohyoid muscle (cut)

Submandibular salivary gland

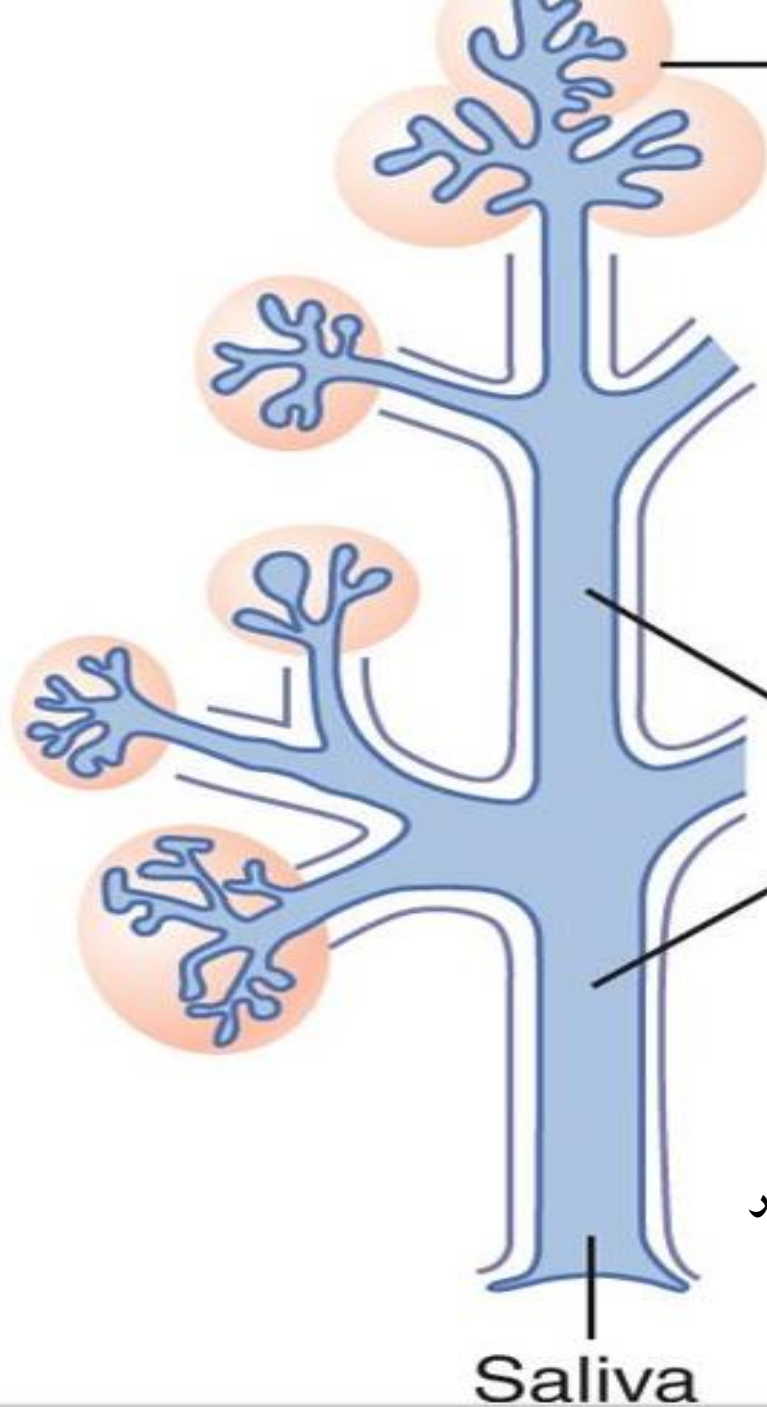
(a) Salivary glands

Salivary Glands

Superficial temporal artery and vein and auriculotemporal



- Saliva contains two major types of protein secretion:
- (1) *Serous secretion* that contains Ptyalin (an α -amylase), which is an enzyme for digesting starches.
- (2) *Mucus secretion* that contains Mucin for lubricating and for surface protective purposes.
- Saliva has a pH between 6.0 and 7.0, a favorable range for the digestive action of ptyalin.



Primary secretion:

1. Ptyalin
2. Mucus
3. Extracellular fluid

Na^+ active absorption
 Cl^- passive absorption
 K^+ active secretion
 HCO_3^- secretion

ال acinus يكون فيها نفس ال compositions in the plasma
 لأنها بتشطف المني من ال plasma، بس بنضاف عليه ال enzymes
 الموجودة زي في ال salivary glands بنضاف ال ptyalin وال mucus

لما ينزل ال primary secretions من ال acinus لل duct بصير
 Na reabsorption والي هيعمل reabsorption of Cl ، و
 secretion of K & Hco_3 (هاد الكلام في ال duct تبعت ال
 salivary glands، يعني بختلف من gland لتانية)

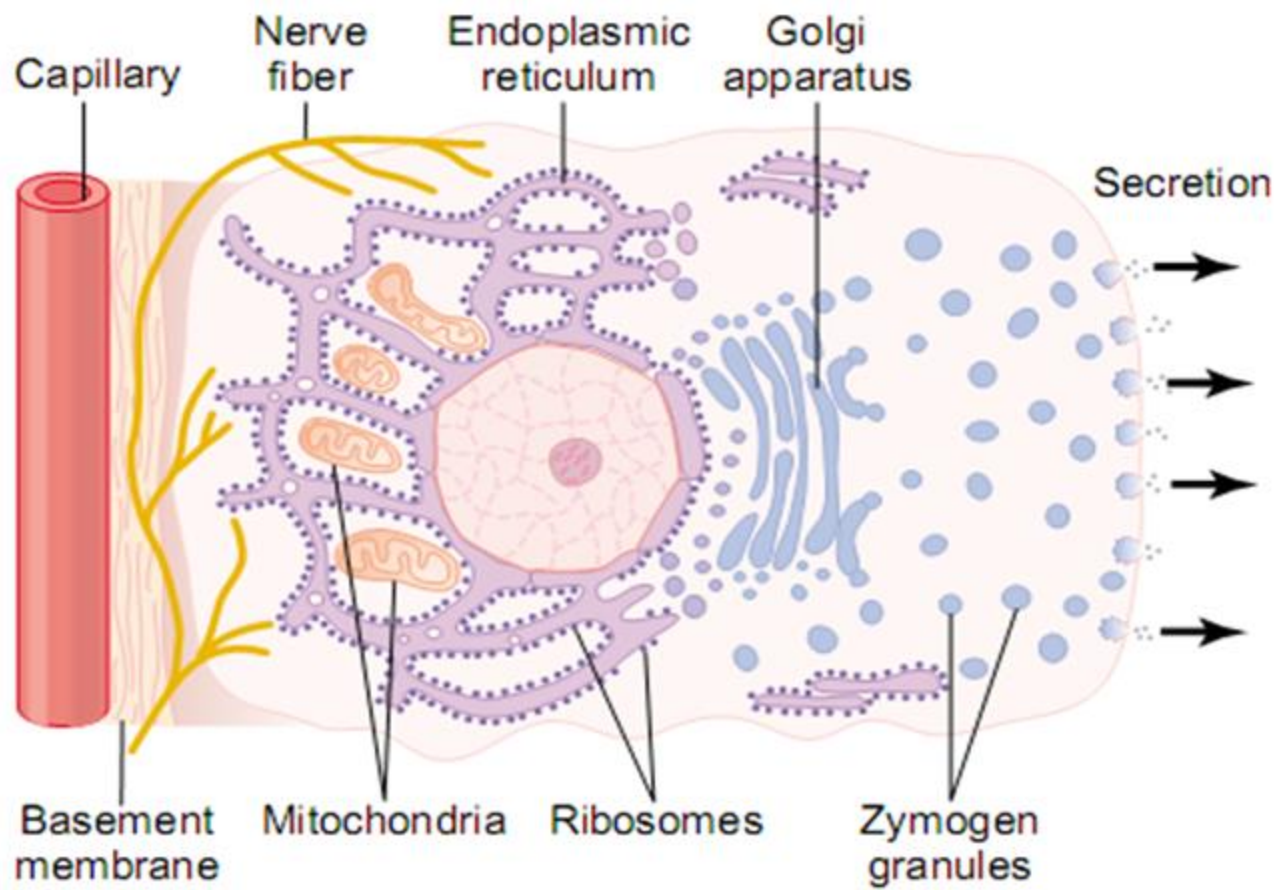
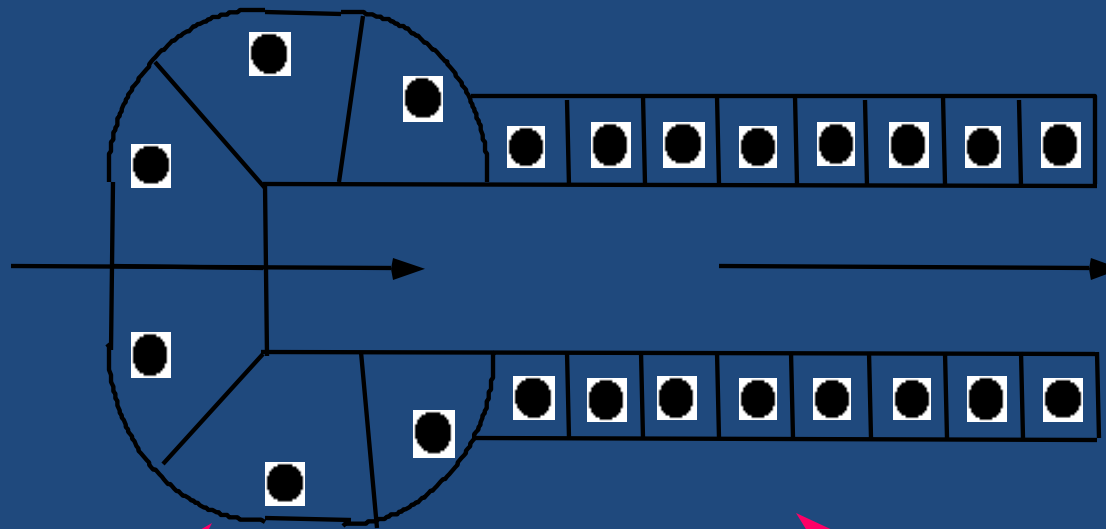


Figure 64-1

THE SECRETORY UNIT

The basic building block of all salivary glands



ACINI - water and ions derived from plasma.

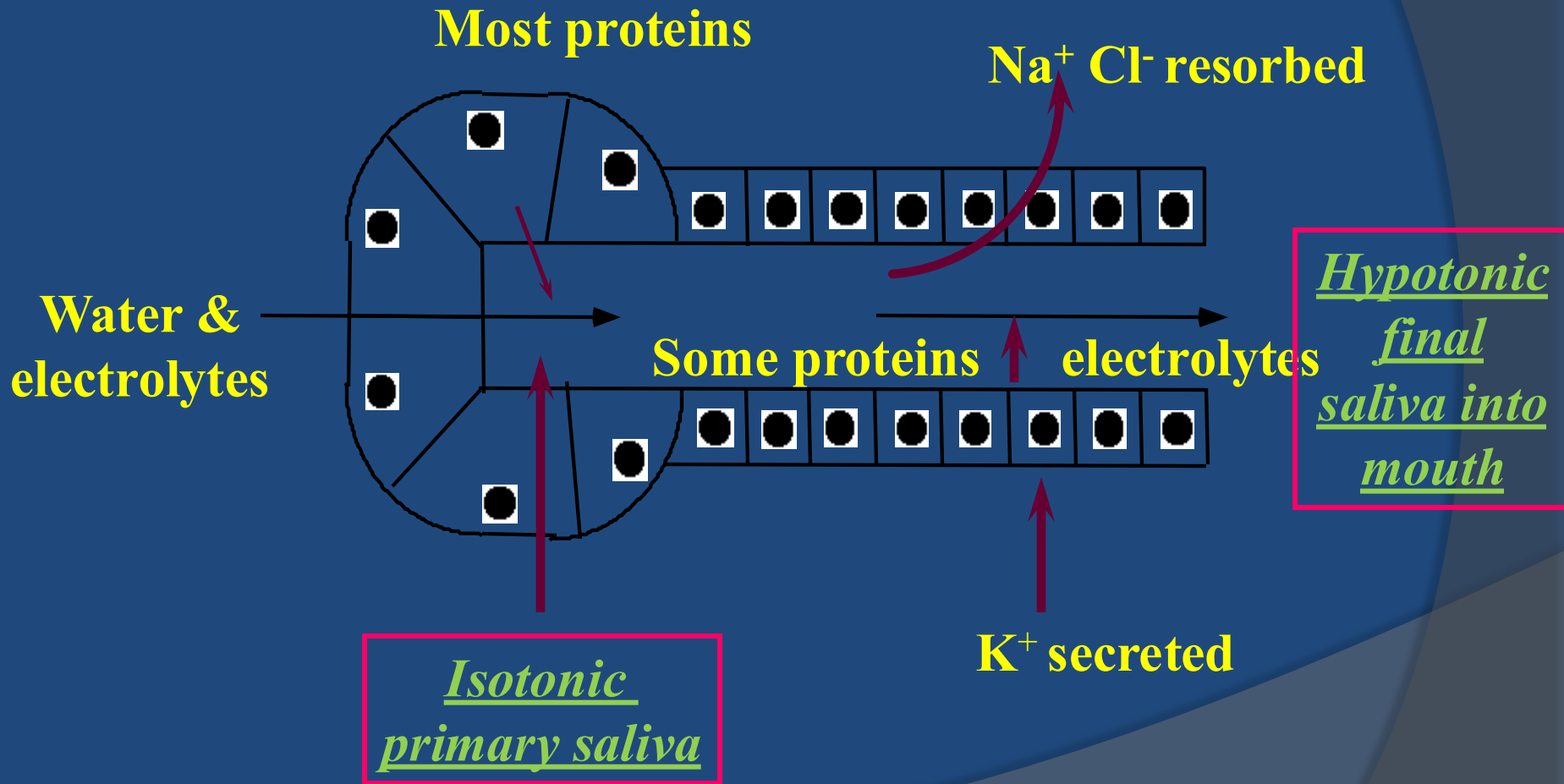
Saliva formed in acini flows down **DUCTS** to empty into the oral cavity.

Secretion of Ions in Saliva :

- Saliva contains especially large quantities of **Potassium and Bicarbonate ions**.
at rest -، ال saliva فيها K سبع أضعاف الي في ال plasma، واحنا حكيما انه الي في البلازما هو 4 ملي مول، معناها الي في ال saliva هو 28 ملي مول - وفيه خمس أضعاف ال Bicarbonate
يصير سبع الموجود في ال plasma، يعني يصير 20-15
- **Sodium and Chloride** ions are several times less in saliva than in plasma.
- **Mechanism of saliva secretion:**
- The Acini secrete a primary secretion that contains ptyalin and/or mucin in a solution of ions in concentrations not greatly different from those of typical extracellular fluid.
- As the primary secretion flows through the Ducts, two major active transport processes take place that markedly modify the ionic composition of the fluid in the saliva.

- First, sodium ions are actively reabsorbed from all the salivary ducts and potassium ions are actively secreted in exchange for the Na
- Second, bicarbonate ions are secreted by the ductal epithelium into the lumen of the duct
- Under resting conditions:
- Sodium and chloride: ions in the saliva are only about 15 mEq/L each, **about one-seventh** to one-tenth their concentrations in plasma.
- Conversely, the concentration of **potassium** ions is about 30 mEq/L, **seven times** as great as in plasma, and the concentration of bicarbonate ions is 50 to 70 mEq/L, about two to three times that of plasma.

SALIVA FORMATION



During maximal salivation: يعني وأنت بتاكل

reabsorption during activity - يعني وأنت قاعد بتاكل وبتمصغ، فـش وقت كثير عشان يصير of Na، فـبدل ما ينزل للسُّبع ممكن ينزل للنص أو للثلث، وفـش وقت انه يصير لل K secretion فـبدل ما هو 30 تلاقيه صار 15 أو 10

■ The rate of formation of primary secretion by the acini can increase as much as 20-fold. 0.5ml/m هو normal rate ال

■ This acinar secretion then flows through the ducts so rapidly that the ductal reconditioning of the secretion is considerably reduced. Therefore, when copious quantities of saliva are being secreted, NaCl concentration is about One-half or two-thirds that of plasma, and the K concentration rises to only Four times that of plasma.

MAJOR FUNCTIONS OF SALIVA

- Solvent
- Buffering
- Lubrication
- Remineralization
- Digestion
- Anti-bacterial
- Anti-fungal
- Temperature regulation
- Production of growth factors and other regulatory peptides

Function of Saliva for Oral Hygiene

About 0.5 milliliter of saliva, almost entirely of the mucous type, is secreted each minute.

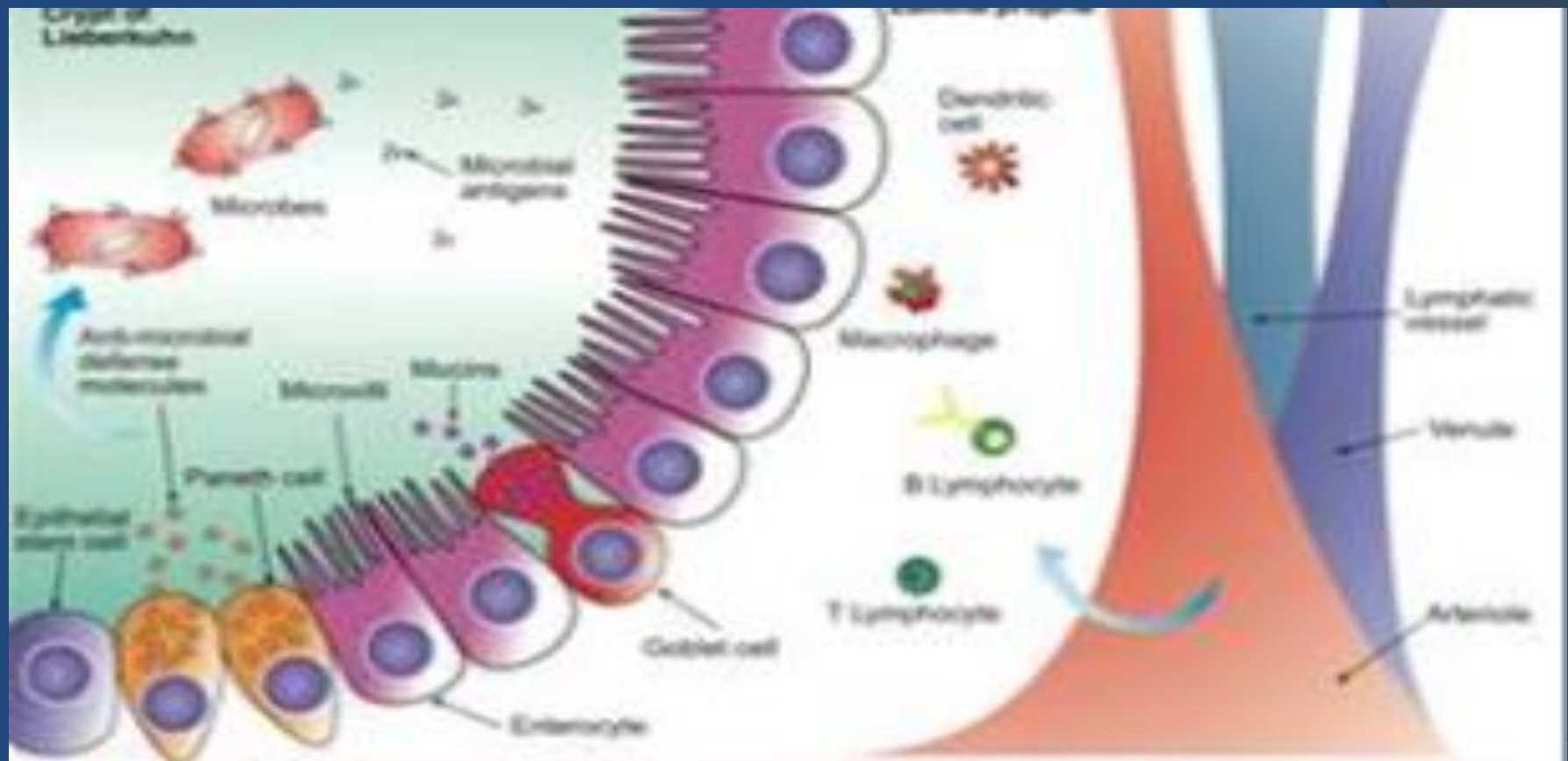
- The flow of saliva itself helps wash away pathogenic bacteria, as well as food particles
- Saliva contains several factors that destroy bacteria. One of these is thiocyanate ions and another is several *proteolytic enzymes*-most important, lysozyme.
- Saliva often contains significant amounts of Protein antibodies that can destroy oral bacteria.

Nervous Regulation of Salivary Secretion

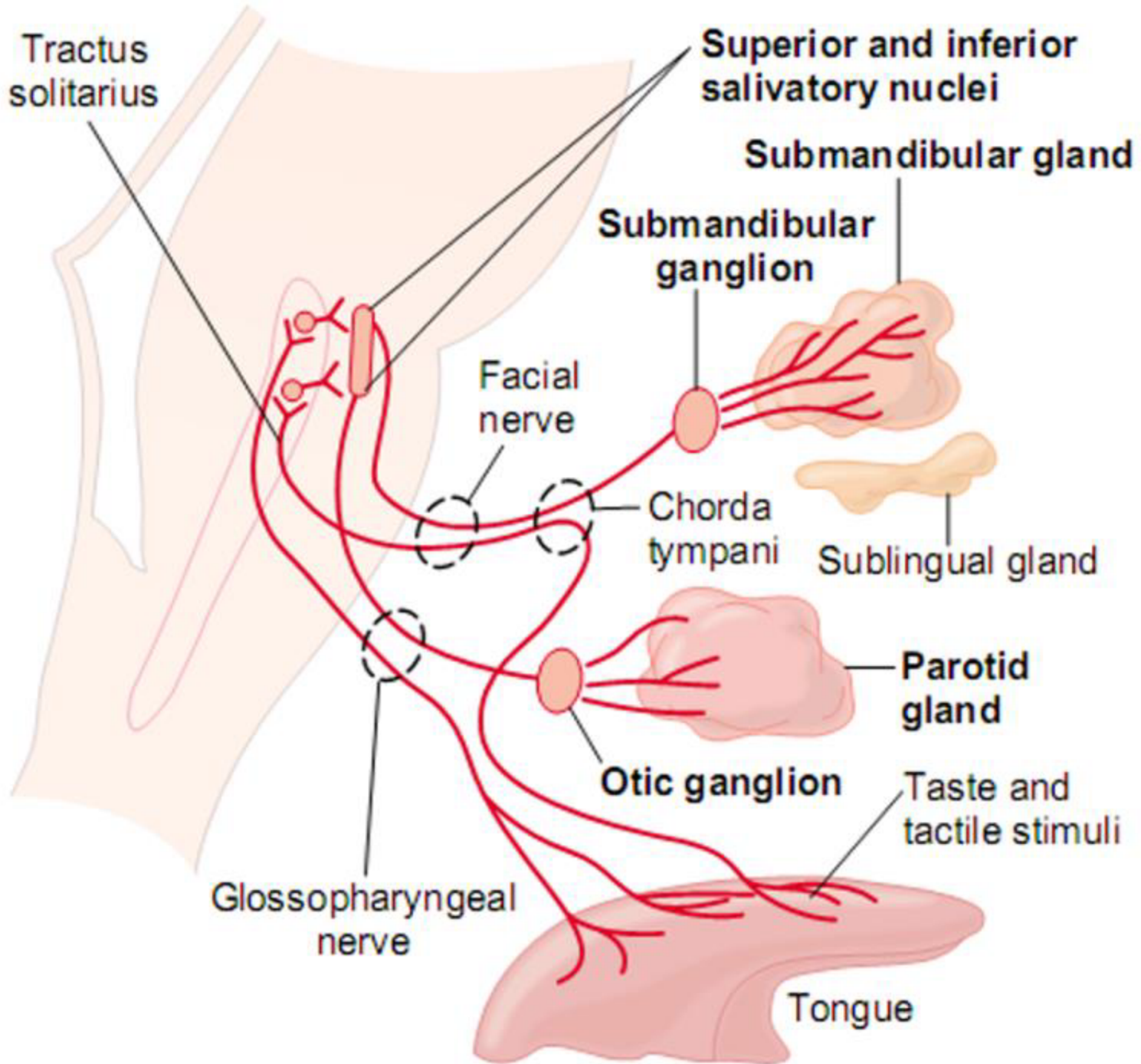
- The salivary glands are controlled mainly by Increase salivary secretions parasympathetic nervous signals all the way from the *superior and inferior salivatory nuclei* in the brain stem. Condition & uncondition reflexes increase salivary reflexes
- Taste and tactile stimuli from the tongue and other areas of the mouth and pharynx.
- Many Taste stimuli, especially the Sour taste (caused by acids), elicit copious secretion of saliva-often 8 to 20 times the basal rate of secretion. عشان يعالج الحامض
- Tactile stimuli, such as the presence of smooth objects in mouth causes marked salivation. لا يسمح الله تهت في الصحراء وريقك ناشف، حط حجرة ملساء في تمك وهتزود ال salivation لما يصير عندك irritation، nausea، بدك تنتق، كل هدول بزودوا ال salivary secretions

uncondition reflexes و condition الی هو ال

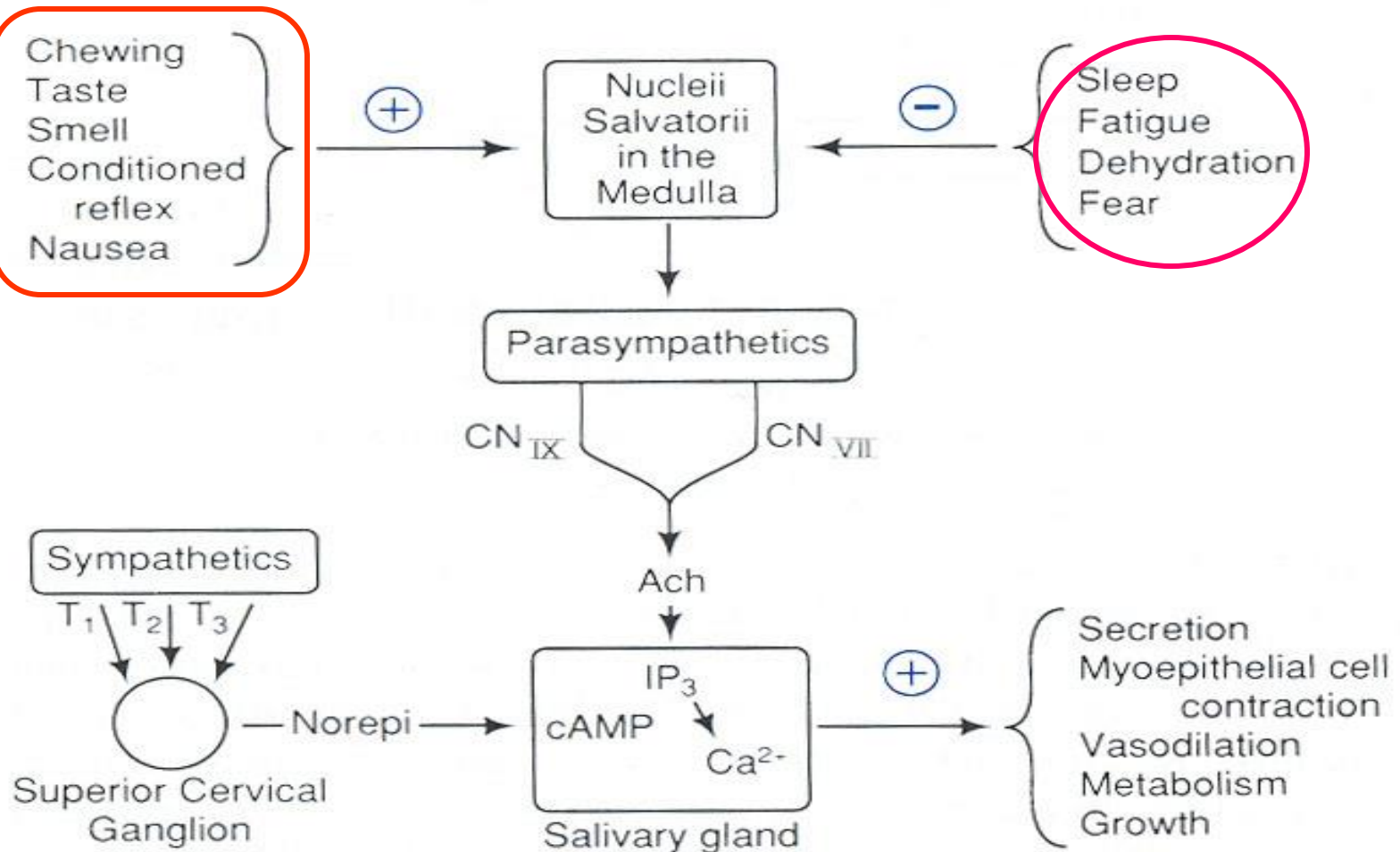
- **Higher centers control:** when a person smells or eats favorite foods, salivation is greater than when disliked food is smelled or eaten(*appetite area* of the brain) .
- **Reflexes originating in the stomach and upper small intestines-**particularly when irritating foods are swallowed or when a person is nauseated .The saliva, when swallowed, helps to remove the irritating factor in the GIT by diluting or neutralizing the irritant substances.
- **Sympathetic stimulation** can also increase salivation a slight amount بس الأساس الی ذکرناهم قبل
- *Blood supply to the glands kallikrein, bradykinin.*



Absorption of nutrients is done by enterocytes that have specialised microvilli on their luminal surfaces (also known as brush border cells). To lubricate and protect the epithelial cells, mucous is produced by goblet cells. The crypts contain the epithelial stem cells that generate new enterocytes and other cell types. They are protected by Paneth cells that secrete antimicrobial defense molecules. The Lamina propria contains immune cells that monitor invasion of the epithelial lining by microorganisms.



Neural regulation of secretion



3-Esophageal Secretion

- The esophageal secretions are Entirely Mucous and mainly provide lubrication for swallowing
بفرز بس mucous، يعني فش فيه enzymes على عكس
ال saliva وال stomach وال small intestine
- *Simple mucous glands: main body.*
يعني فوق
- *Compound mucous glands :At lower end& to lesser extent the initial portion ,which prevent peptic ulceration.*
عشان أحياناً بصير ارتجاع والحامض يطلع لفوق
- هادي بتفرز mucous و small portion of alkali