HOẠT ĐỘNG BÀI TIẾT, TIÊU HÓA , HẤP THU

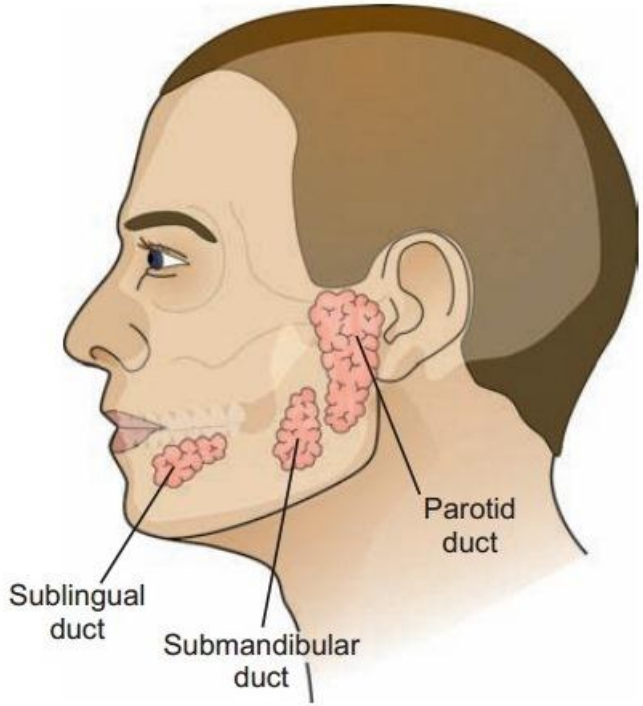
BS Nguyễn Bình Thư

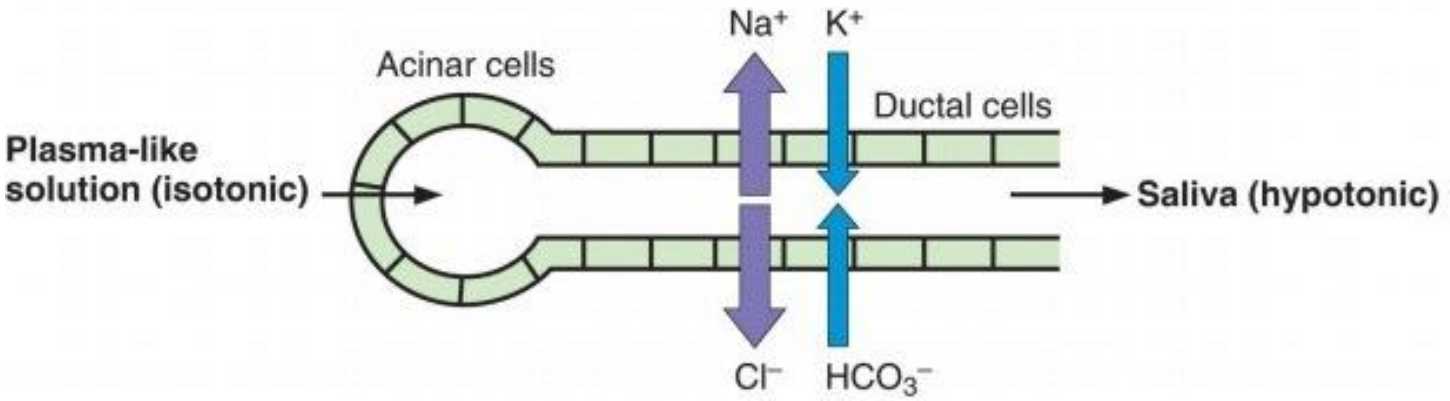
MỤC TIÊU

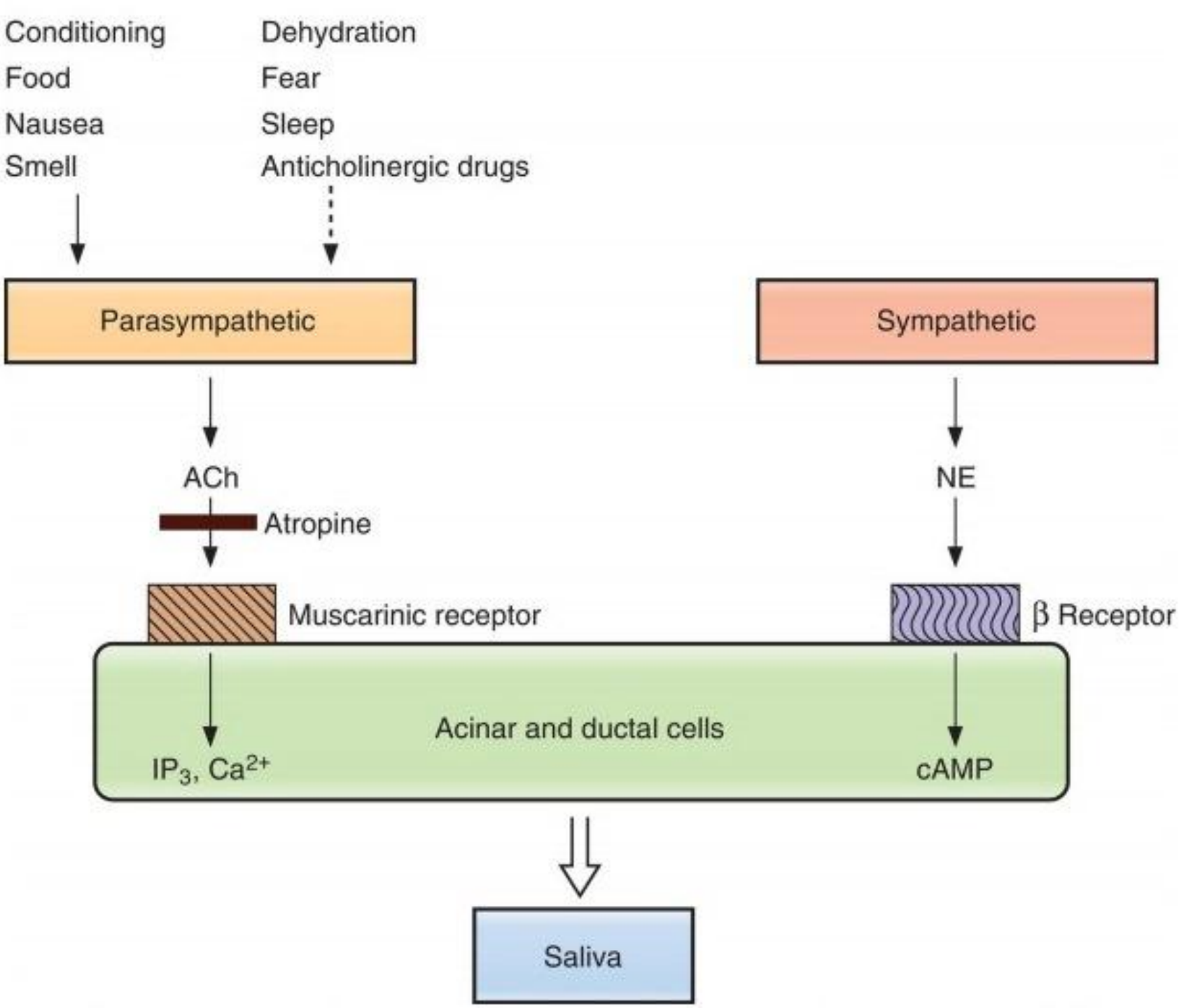
1) Liệt kê và trình bày được chức năng các chất tiết từ đường tiêu hóa.
2) Trình bày được quá trình tiêu hóa và hấp thu chất dinh dưỡng.

HOẠT ĐỘNG BÀI TIẾT

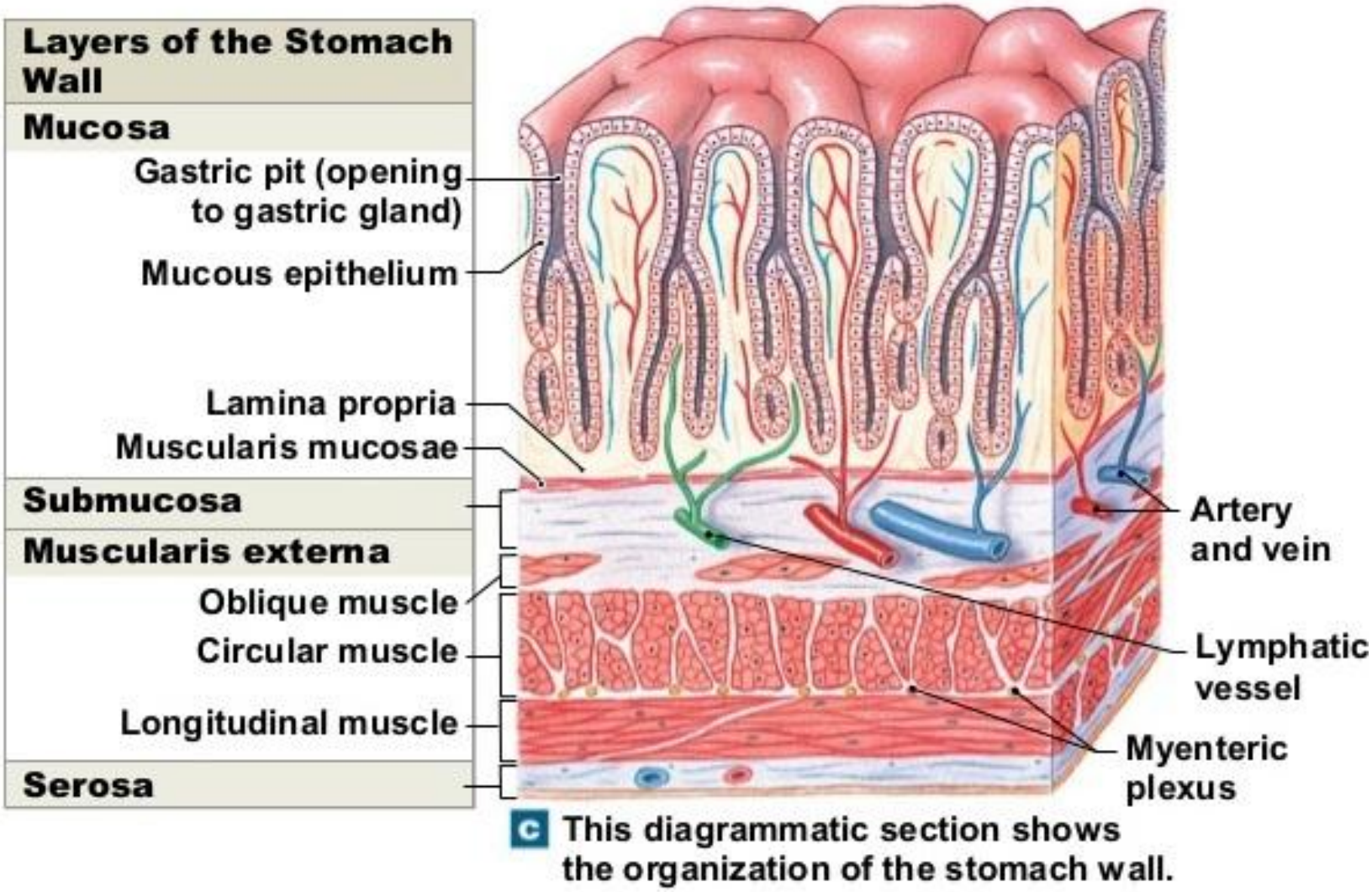
BÀI TIẾT NƯỚC BỌT





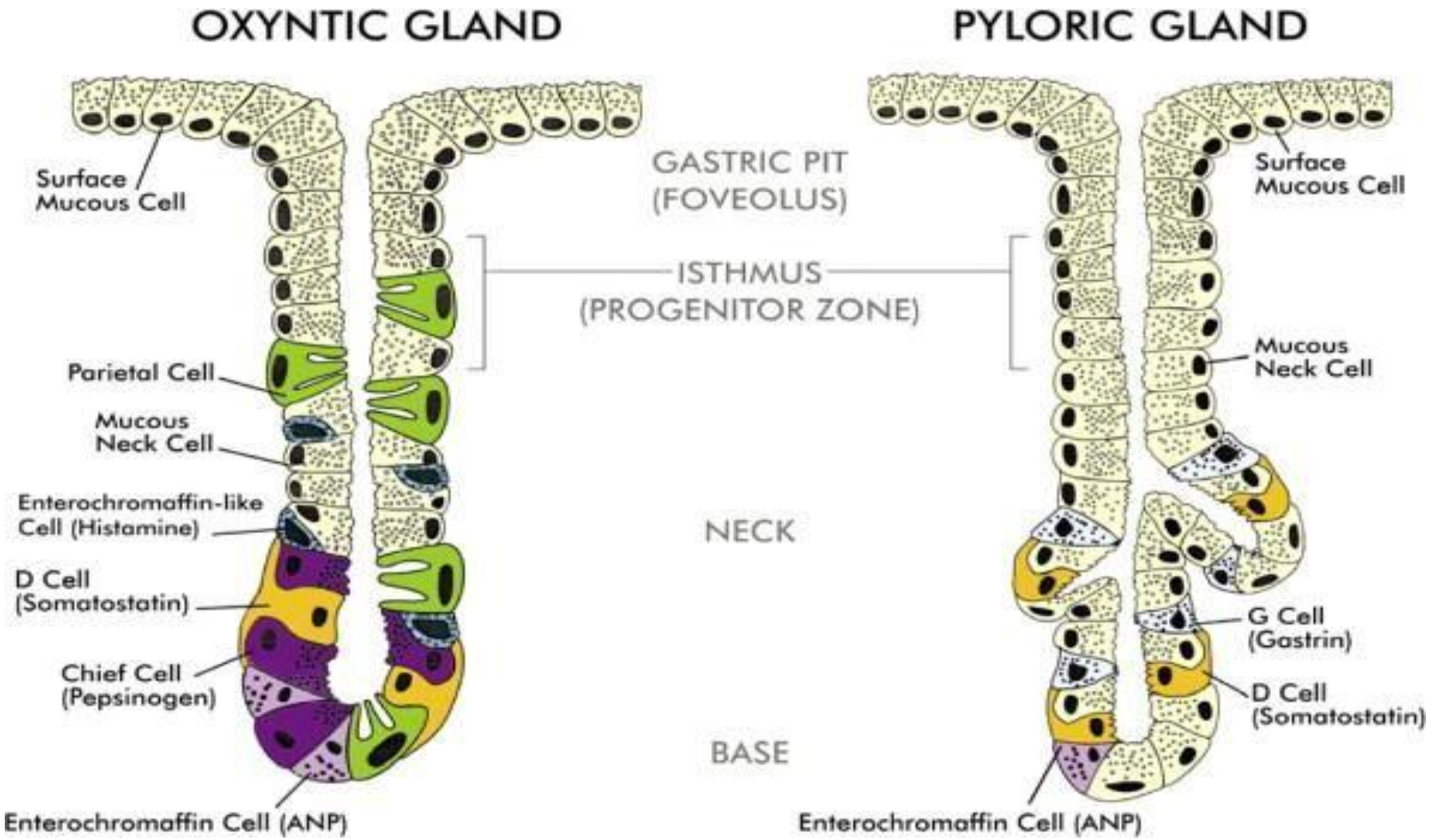

Conditioning
Food
Nausea
Smell
Dehydration
Fear
Sleep
Anticholinergic drugs
Parasympathetic
Sympathetic
ACh
Atropine
NE
Muscarinic receptor
β Receptor
Acinar and ductal cells
IP3, Ca2+
cAMP
Saliva

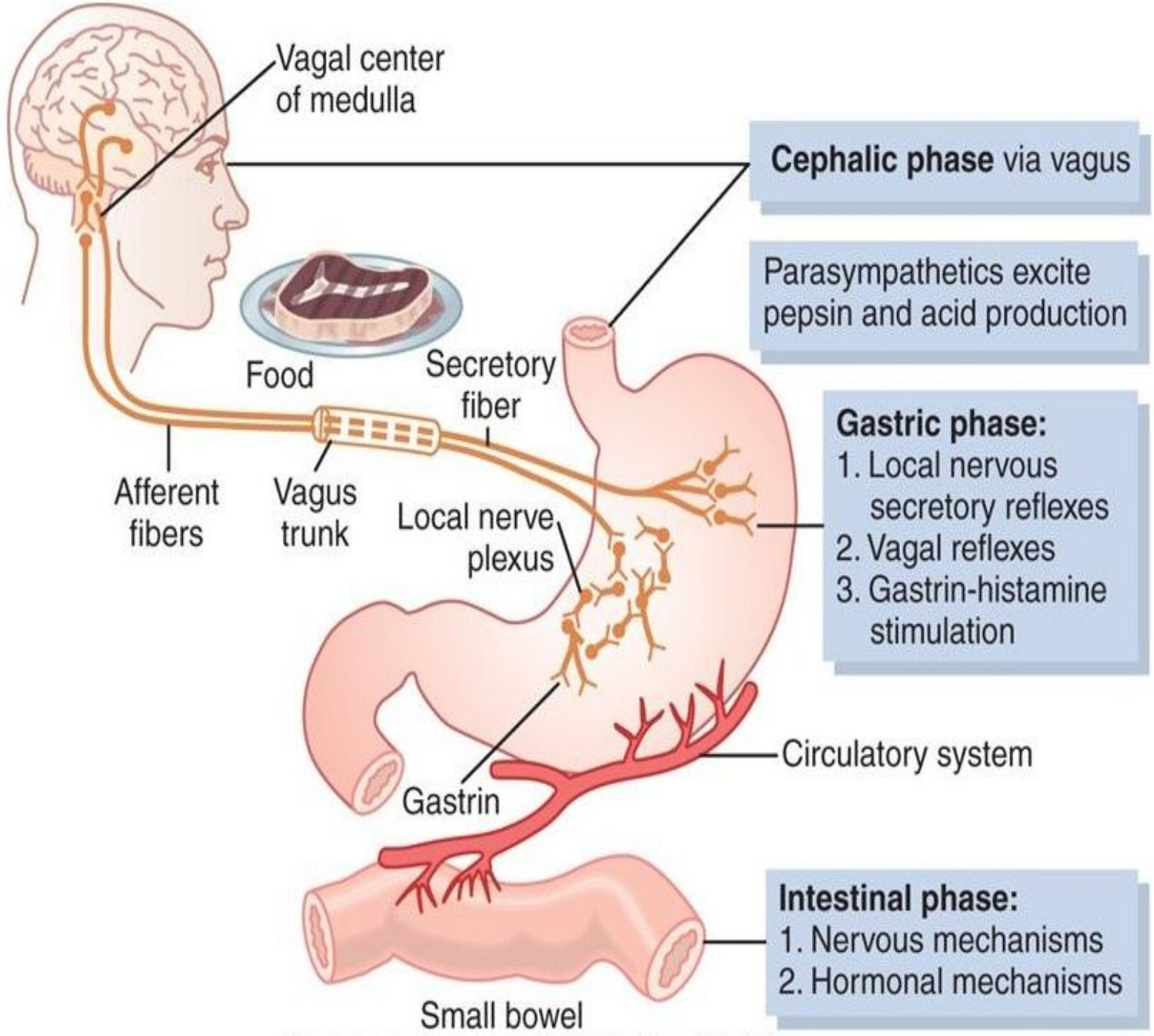
BÀI TIẾT DỊCH VỊ



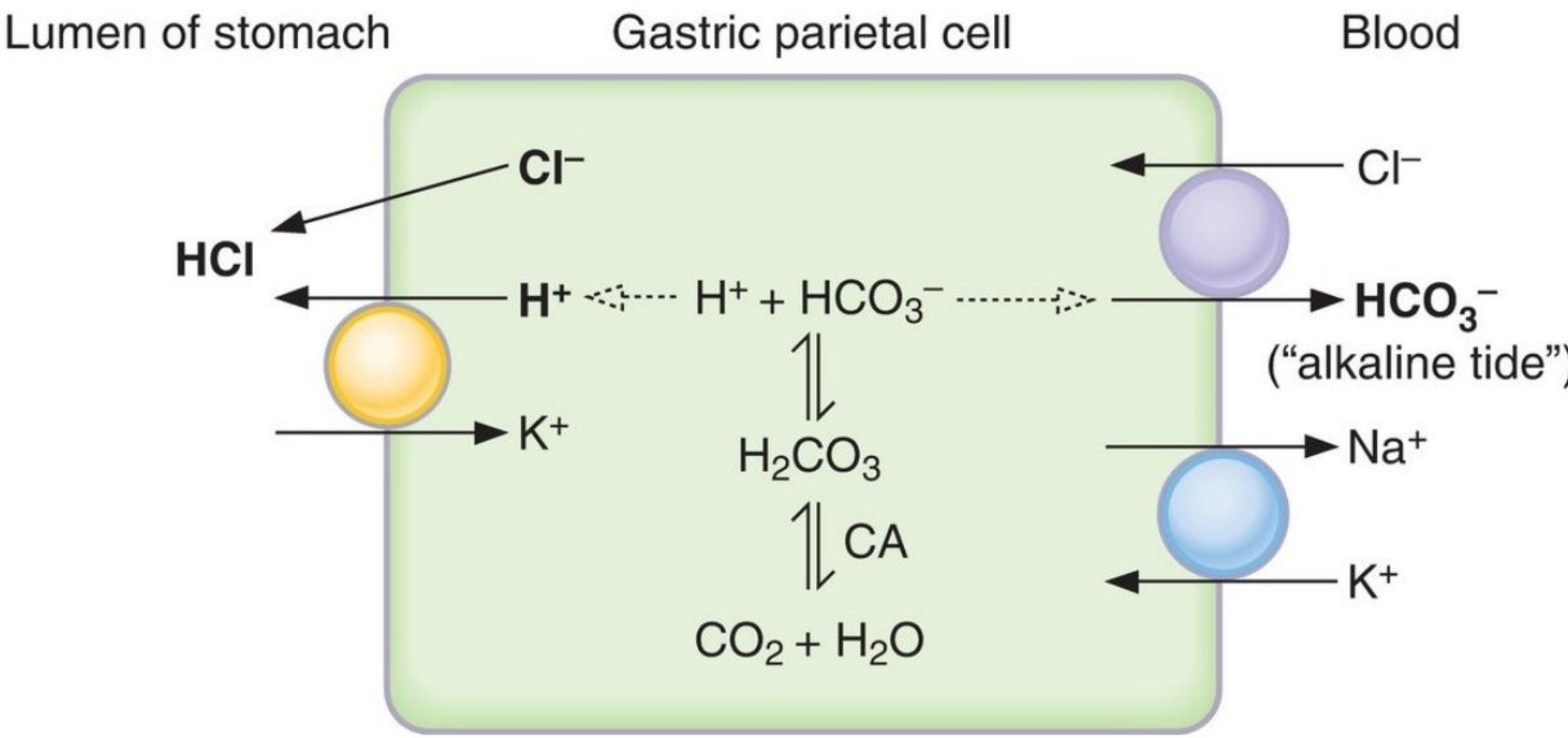
C This diagrammatic section shows the organization of the stomach wall.

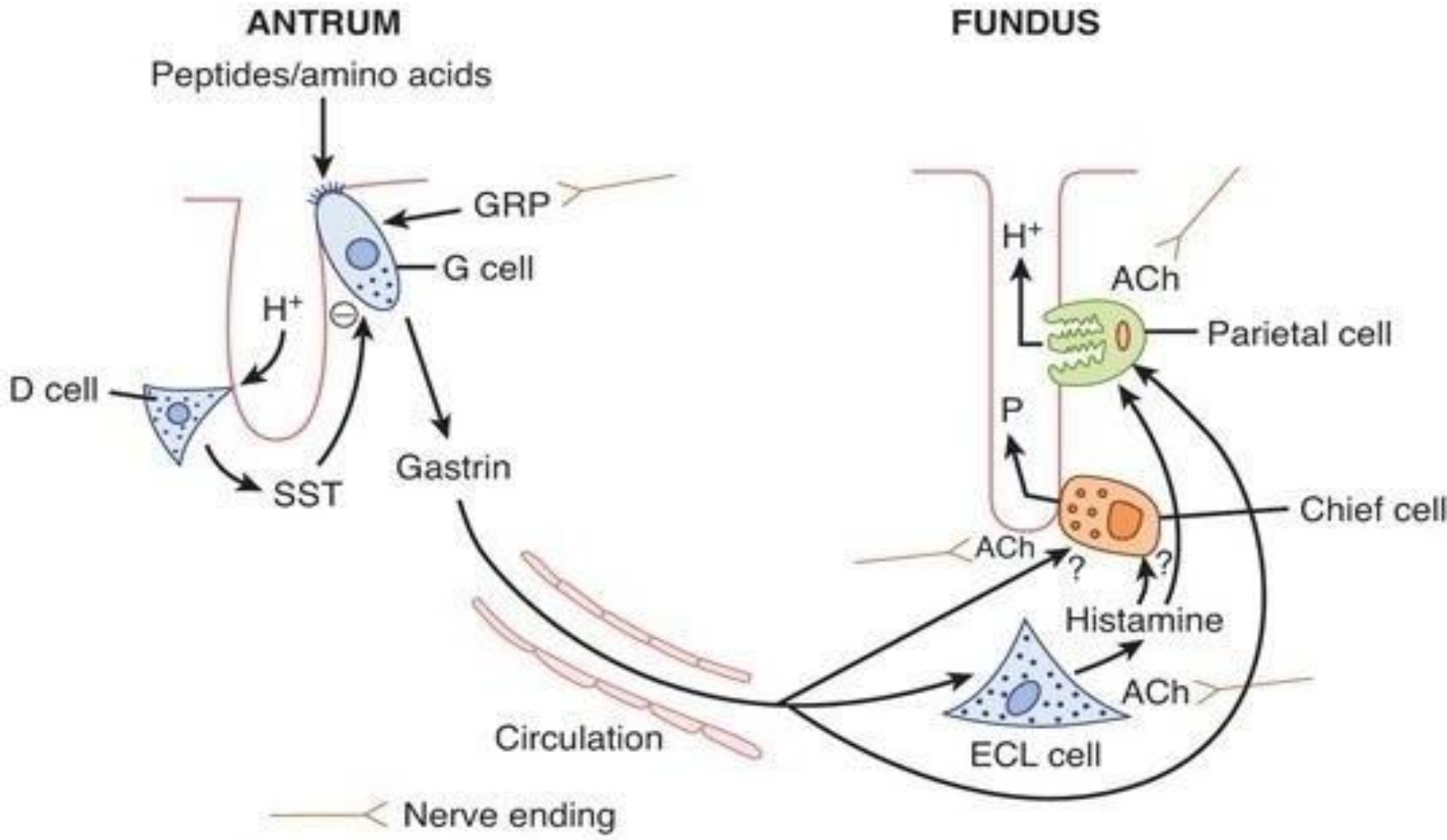
Các tuyến dạ dày

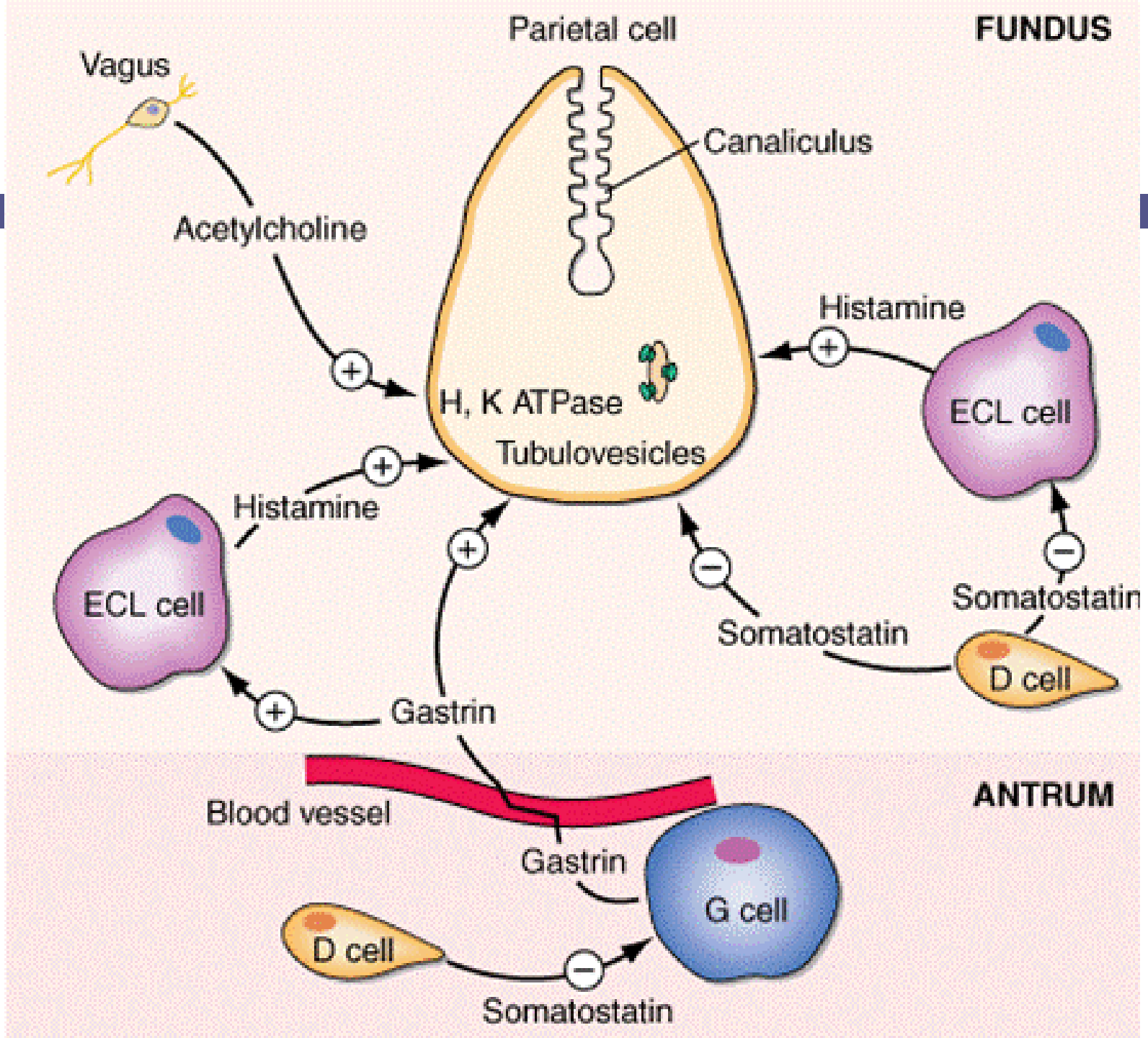


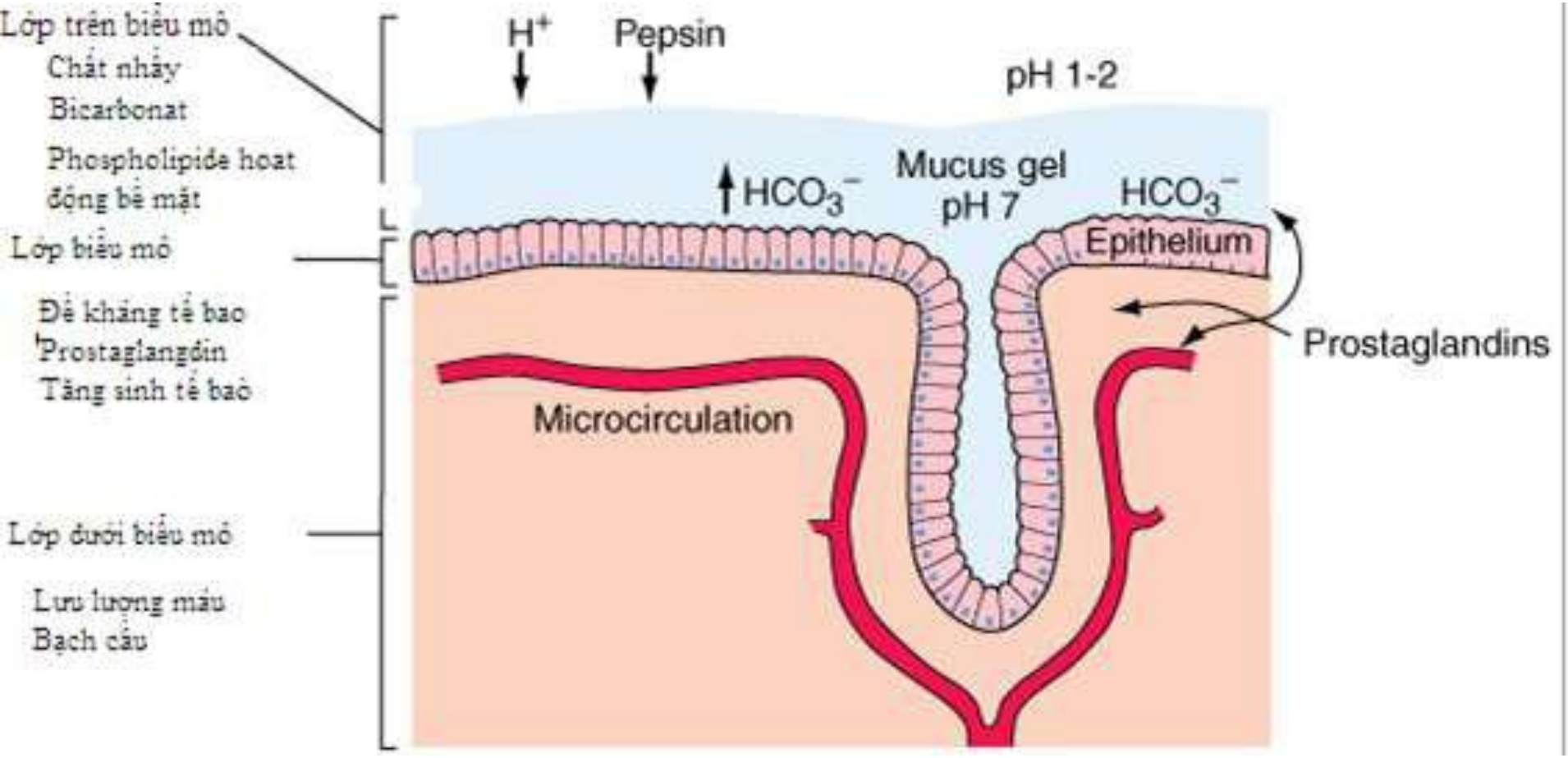

Vagal center of medulla
Cephalic phase via vagus
Parasympathetics excite pepsin and acid production
Food
Secretory fiber
Afferent fibers
Vagus trunk
Local nerve plexus
Gastric phase:
1. Local nervous secretory reflexes
2. Vagal reflexes
3. Gastrin-histamine stimulation
Circulatory system
Gastrin
Intestinal phase:
1. Nervous mechanisms
2. Hormonal mechanisms
Small bowel

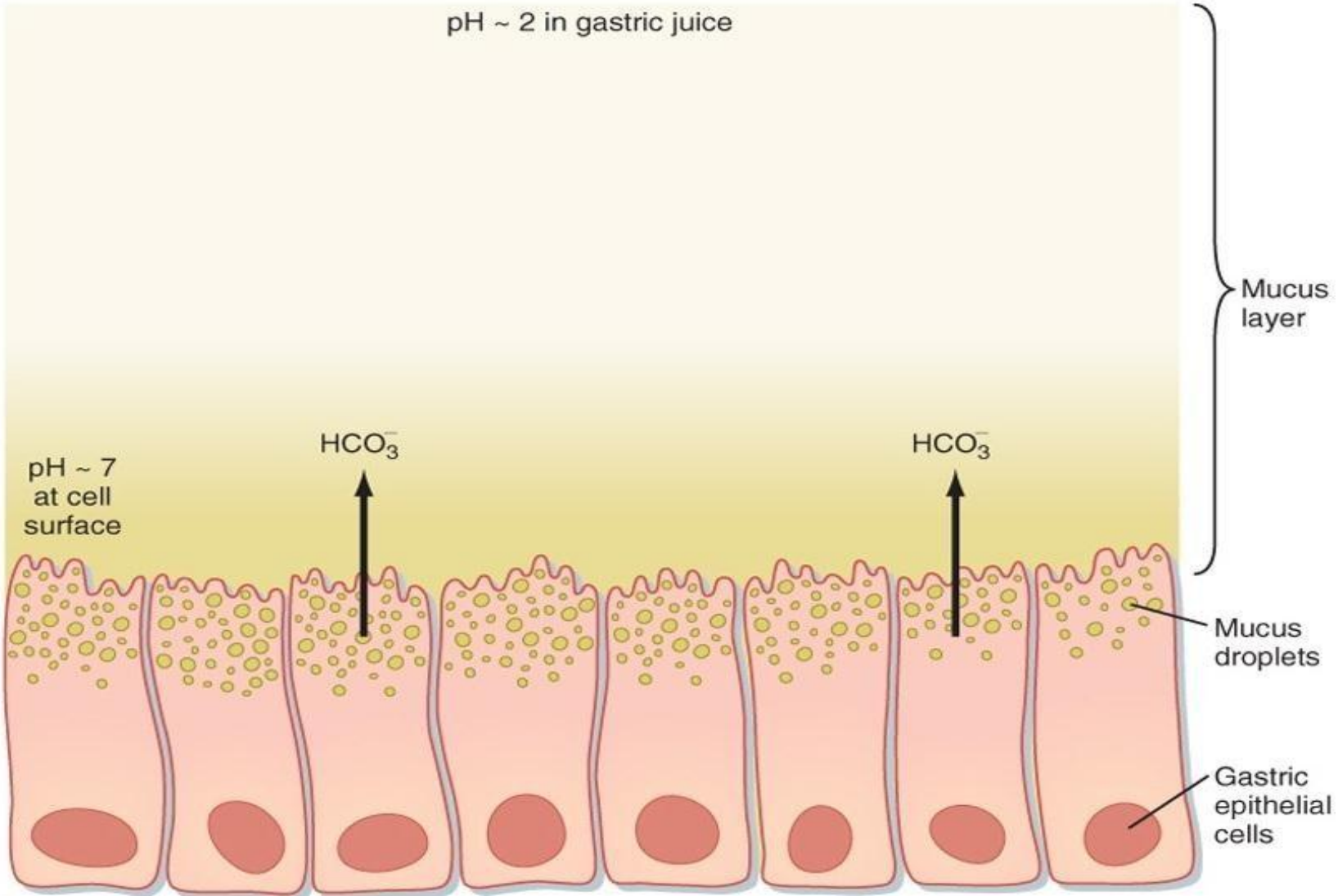
Cơ chế bài tiết H^+

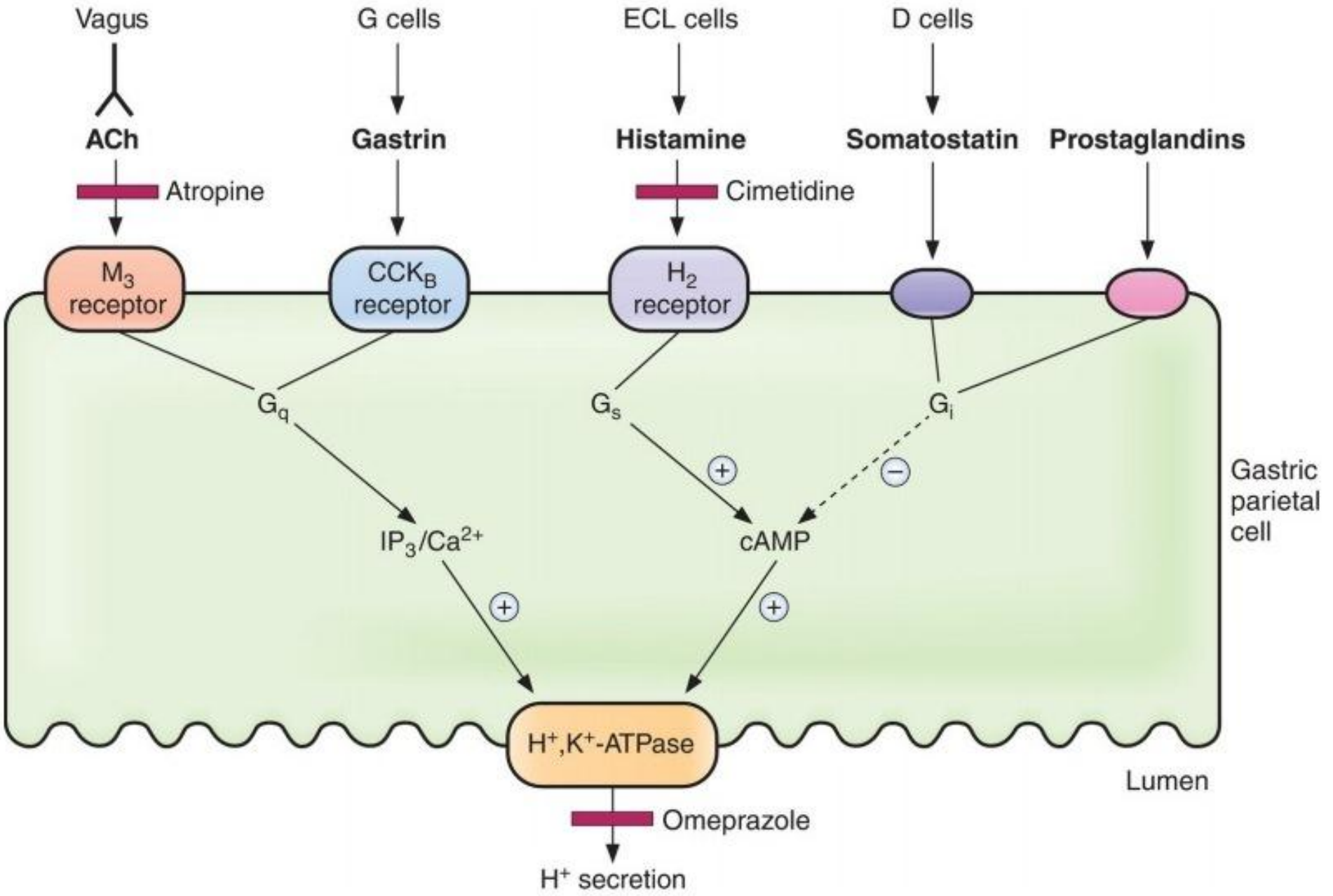



ANTRUM
FUNDUS
Peptides/amino acids
GRP
G cell
H+
D cell
SST
Gastrin
H+
ACh
Parietal cell
P
Chief cell
ACh
?
?
Histamine
ACh
ECL cell
Circulation
Nerve ending


Parietal cell
FUNDUS
Vagus
Canaliculus
Acetylcholine
Histamine
H, K ATPase
ECL cell
Tubulovesicles
Histamine
ECL cell
Somatostatin
Somatostatin
D cell
Gastrin
Blood vessel
ANTRUM
Gastrin
G cell
D cell
Somatostatin


Lớp trên biểu mô
Chất nhầy
Bicarbonat
Phospholipide hoạt động bề mặt
Lớp biểu mô
Đề kháng tế bào
Prostaglangdin
Tăng sinh tế bào
Lớp dưới biểu mô
Lưu lượng máu
Bạch cầu
H+
Pepsin
pH 1-2
HCO3−
Mucus gel
pH 7
HCO3−
Epithelium
Prostaglandins
Microcirculation

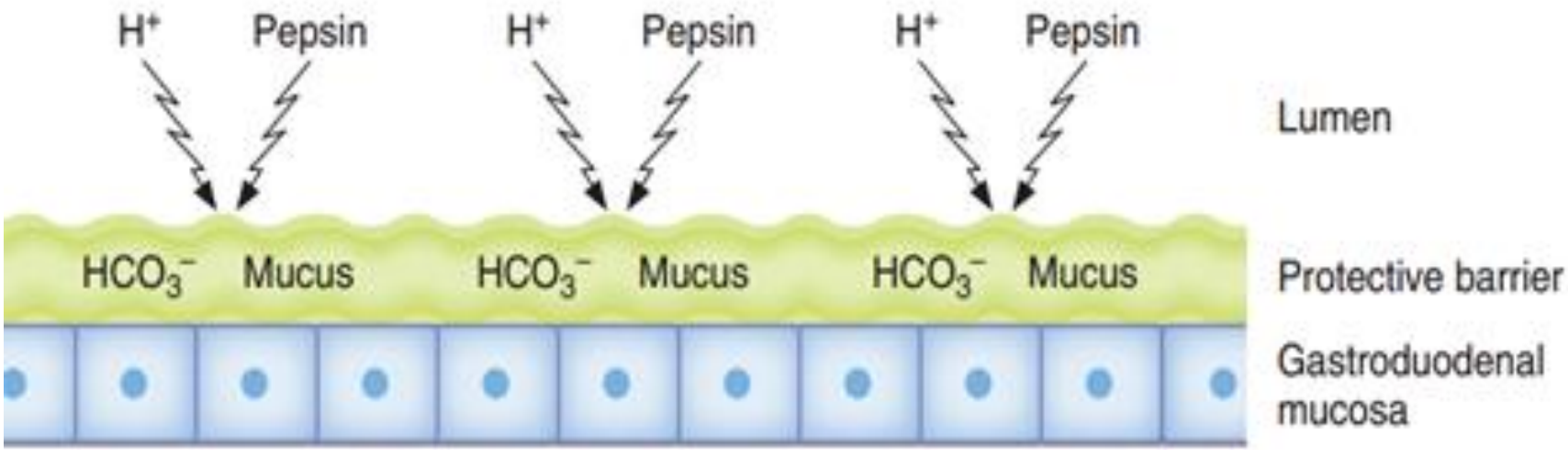

pH ~ 2 in gastric juice
Mucus layer
pH ~ 7 at cell surface
HCO_3^-
HCO_3^-
Mucus droplets
Gastric epithelial cells


Vagus
G cells
ECL cells
D cells
ACh
Gastrin
Histamine
Somatostatin
Prostaglandins
Atropine
Cimetidine
M3 receptor
CCKB receptor
H2 receptor
Gq
Gs
Gi
IP3/Ca2+
cAMP
Gastric parietal cell
H+,K+-ATPase
Lumen
Omeprazole
H+ secretion

Cell Type	Part of Stomach	Secretion Products	Stimulus for Secretion
Parietal cells	Body (fundus)	HCl Intrinsic factor (essential)	Gastrin Vagal stimulation (ACh) Histamine
Chief cells	Body (fundus)	Pepsinogen (converted to pepsin at low pH)	Vagal stimulation (ACh)
G cells	Antrum	Gastrin	Vagal stimulation (via GRP) Small peptides Inhibited by somatostatin Inhibited by H^+ in stomach (via stimulation of somatostatin release)
Mucous cells	Antrum	Mucus Pepsinogen	Vagal stimulation (ACh)

ACh = acetylcholine; GRP = gastrin-releasing peptide.

Bệnh lý tại dạ dày



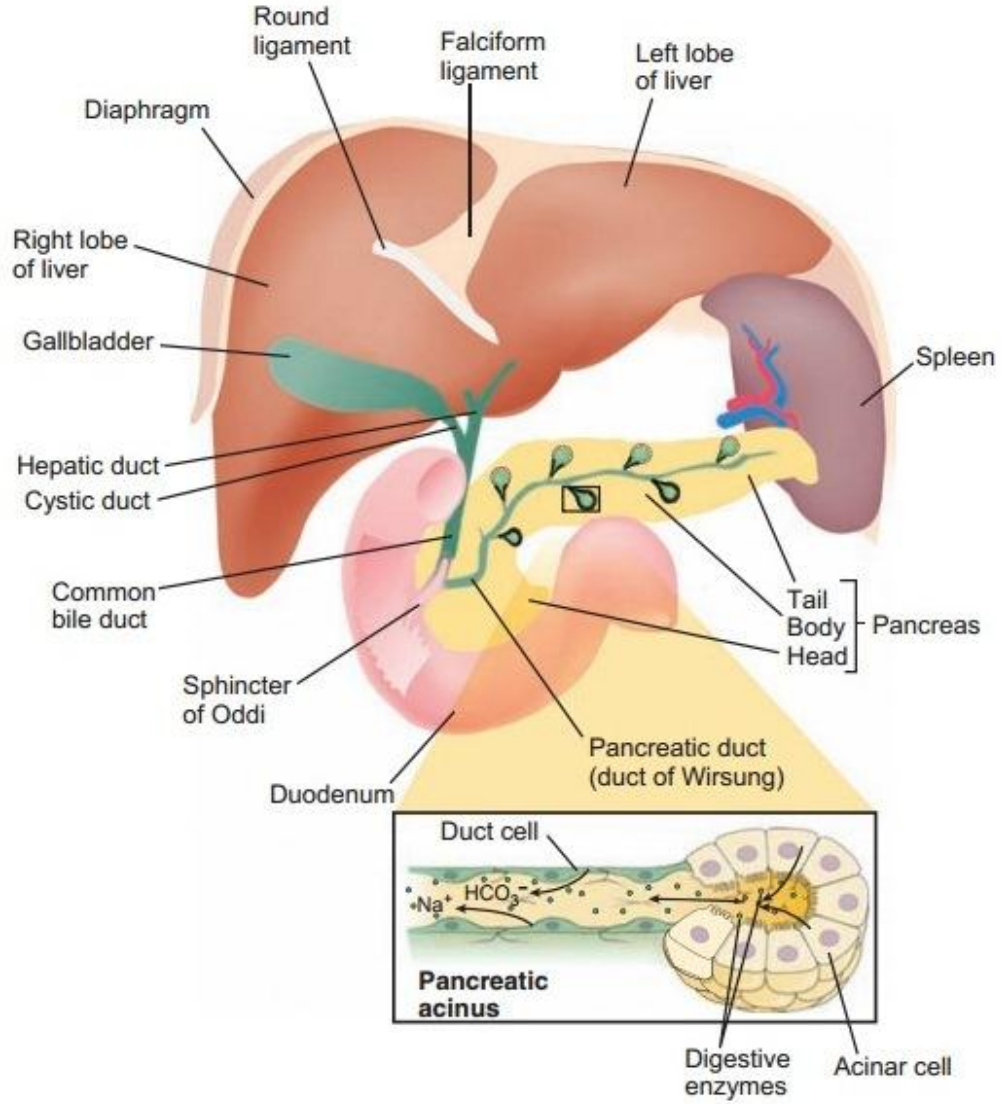
Protective factors

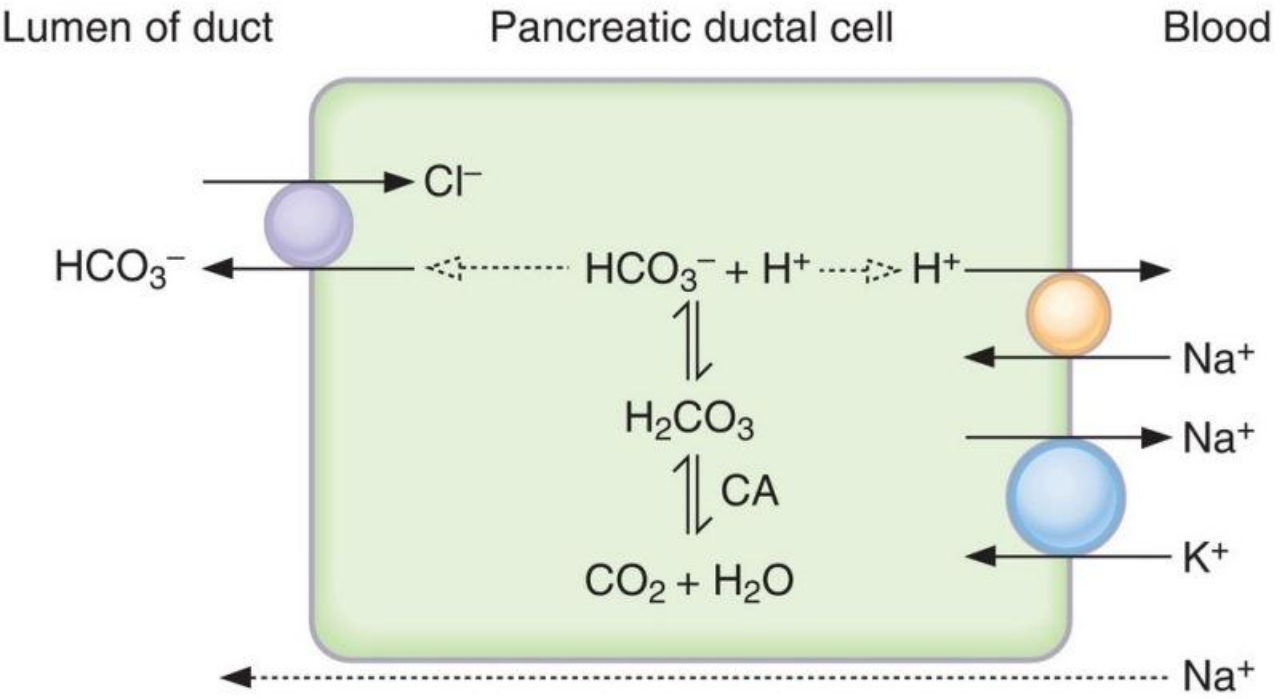
* HCO_3^- and mucus
Prostaglandins
Mucosal blood flow
Growth factors

Damaging factors

* H^+ and pepsin
H. pylori
NSAIDs
Stress
Smoking
Alcohol

BÀI TIẾT DỊCH TỤY




Lumen of duct
Pancreatic ductal cell
Blood
Cl⁻
HCO3⁻
HCO3⁻ + H+
H+
Na+
H2CO3
Na+
CA
K+
CO2 + H2O
Na+

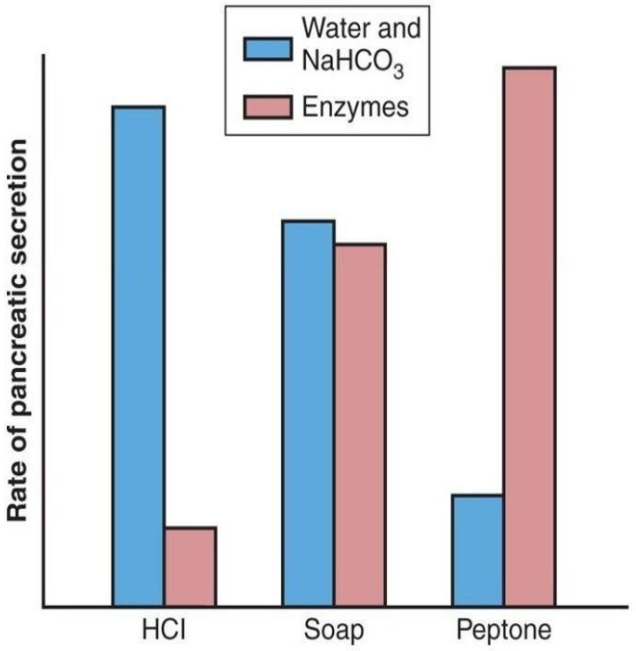
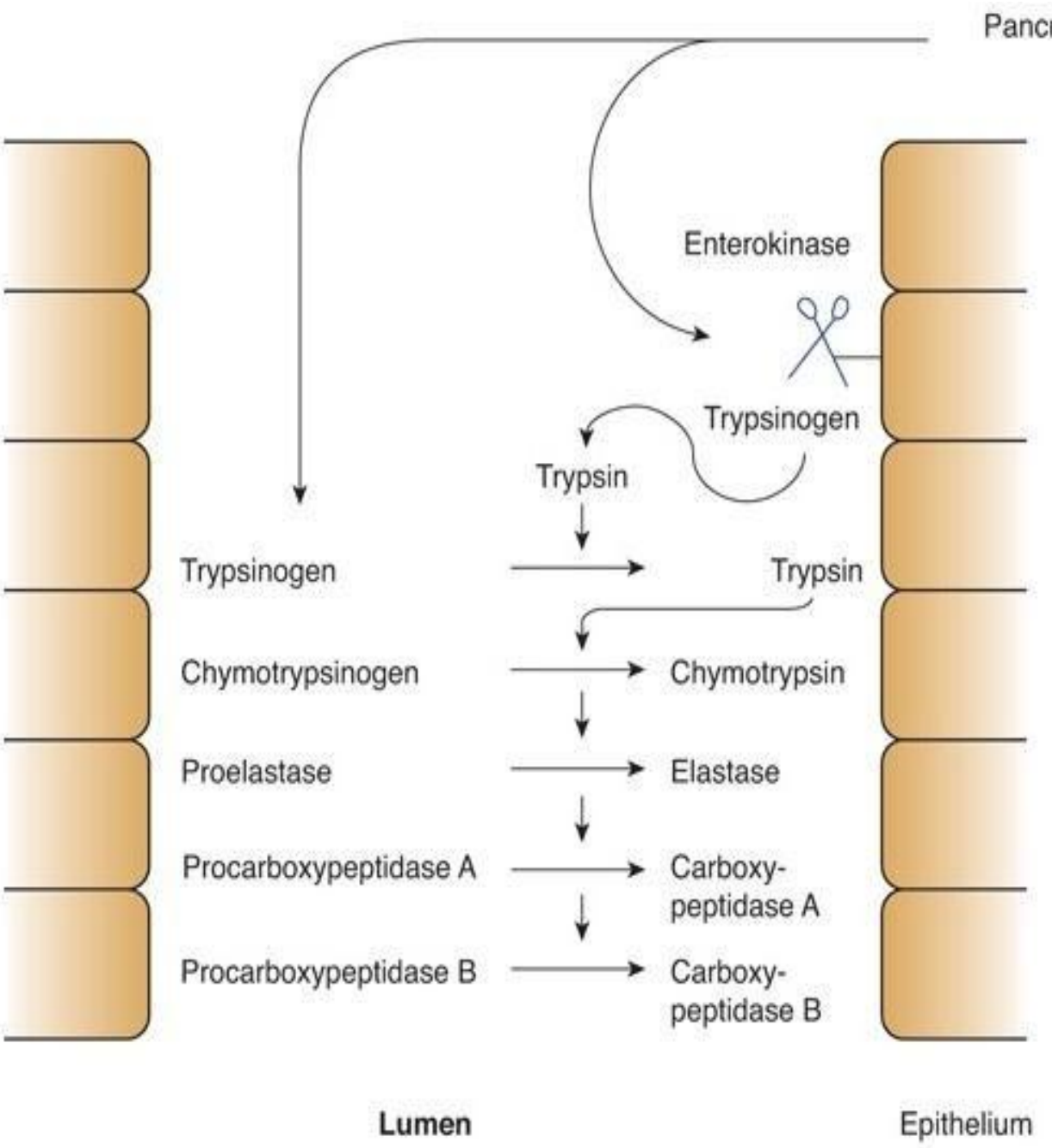
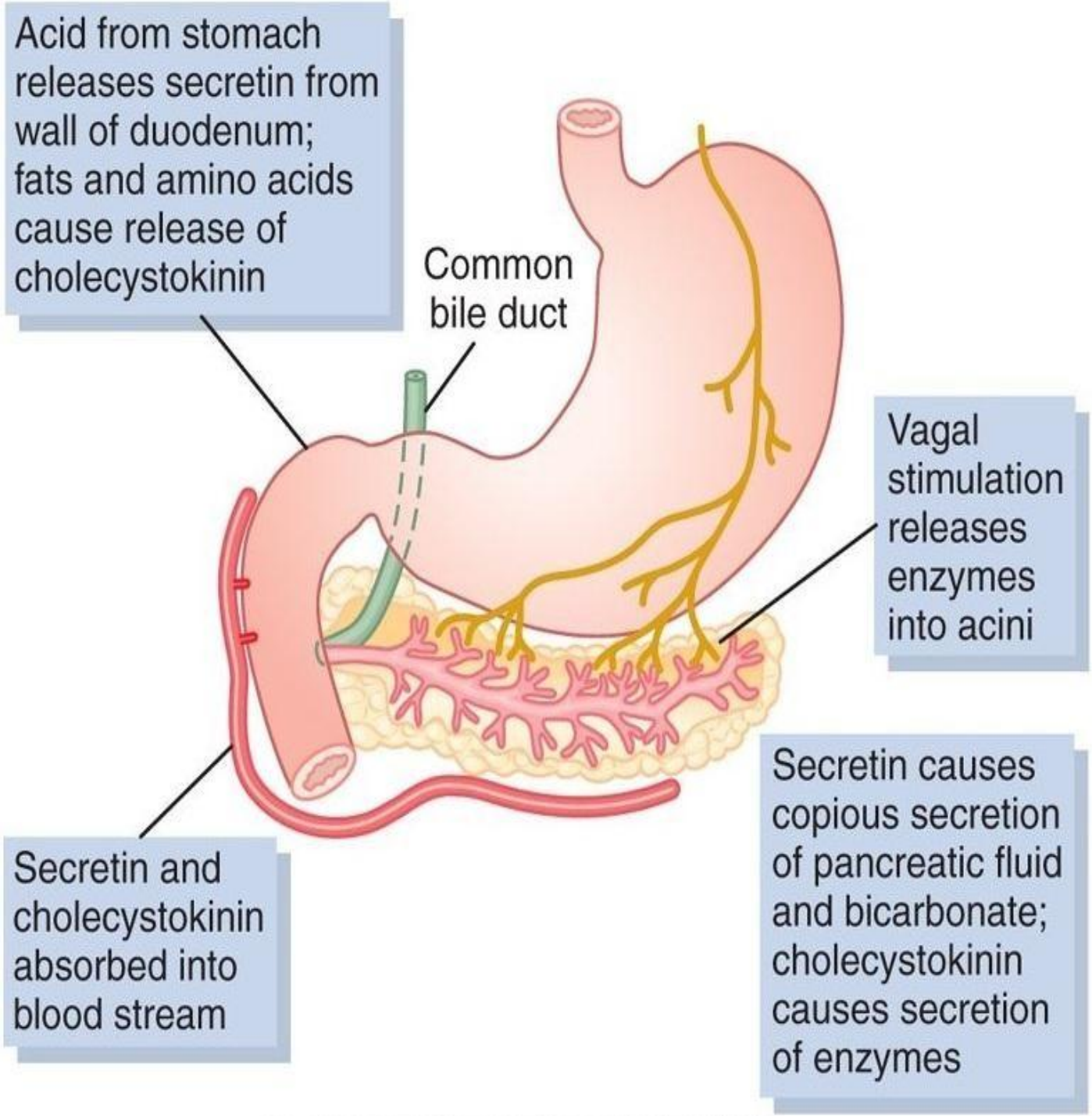

Water and NaHCO3
Enzymes
Rate of pancreatic secretion
HCl
Soap
Peptone

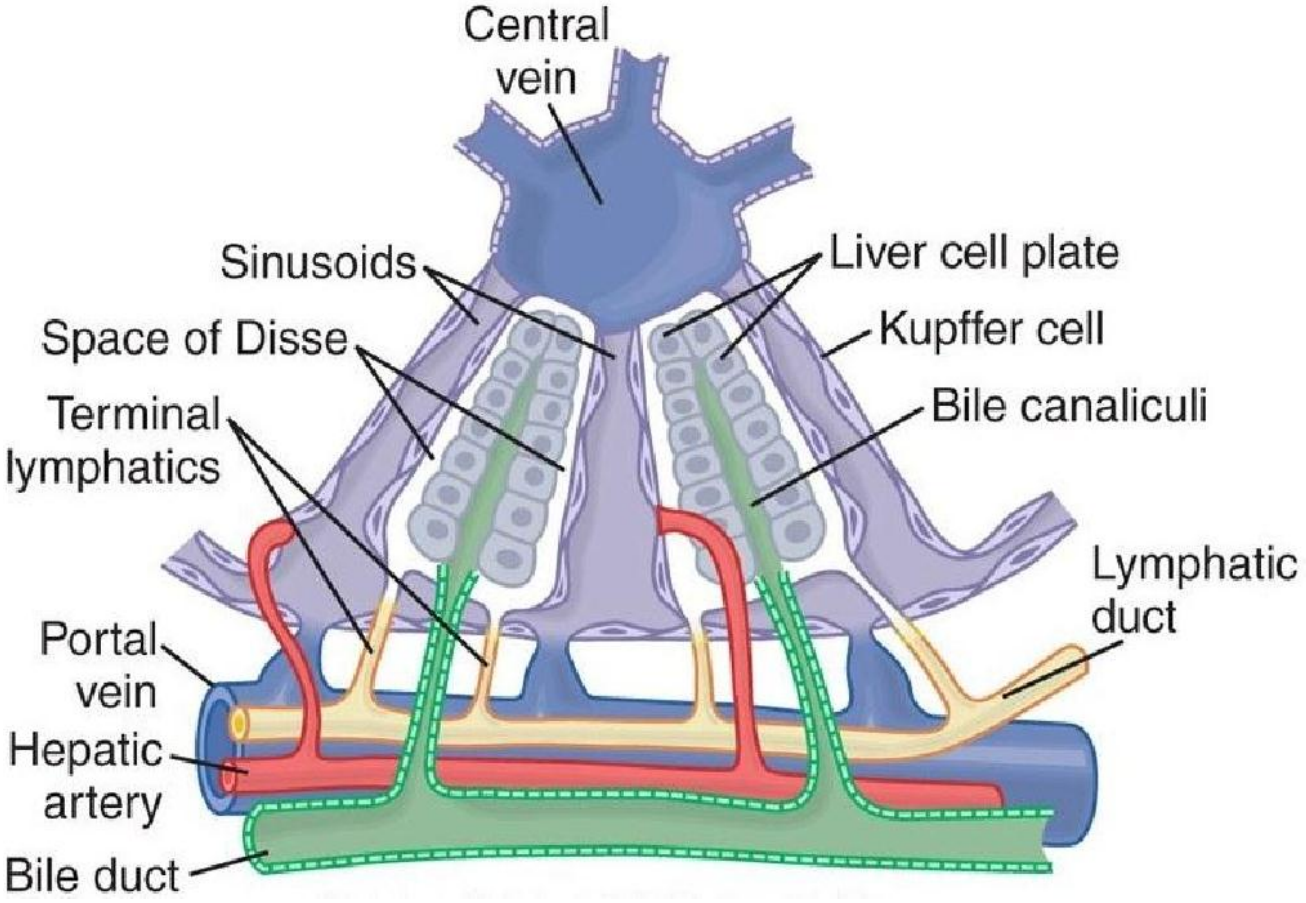
TABLE 26.2 The Pancreas is the Main Digestive Gland of the Body

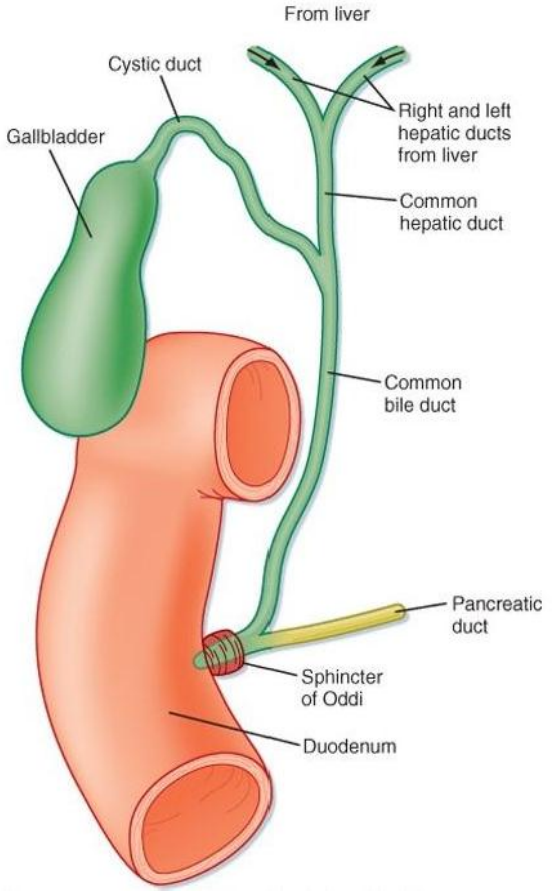
Enzyme Secreted	Hydrolytic Action
Trypsin	Protease that breaks down proteins at the basic amino acids
Chymotrypsin	Protease that breaks down proteins at the aromatic amino acids
Lipase	Degrades triglycerides into fatty acids and glycerol
Carboxypeptidase	Protease that takes off the terminal acid group from a protein
Elastases	Degrade the protein elastin and some other proteins
Nucleases	Degrade nucleic acids, like DNAase and RNAase
Pancreatic amylase	Besides starch and glycogen, degrades most other carbohydrates; humans lack the enzyme to digest the carbohydrate cellulose

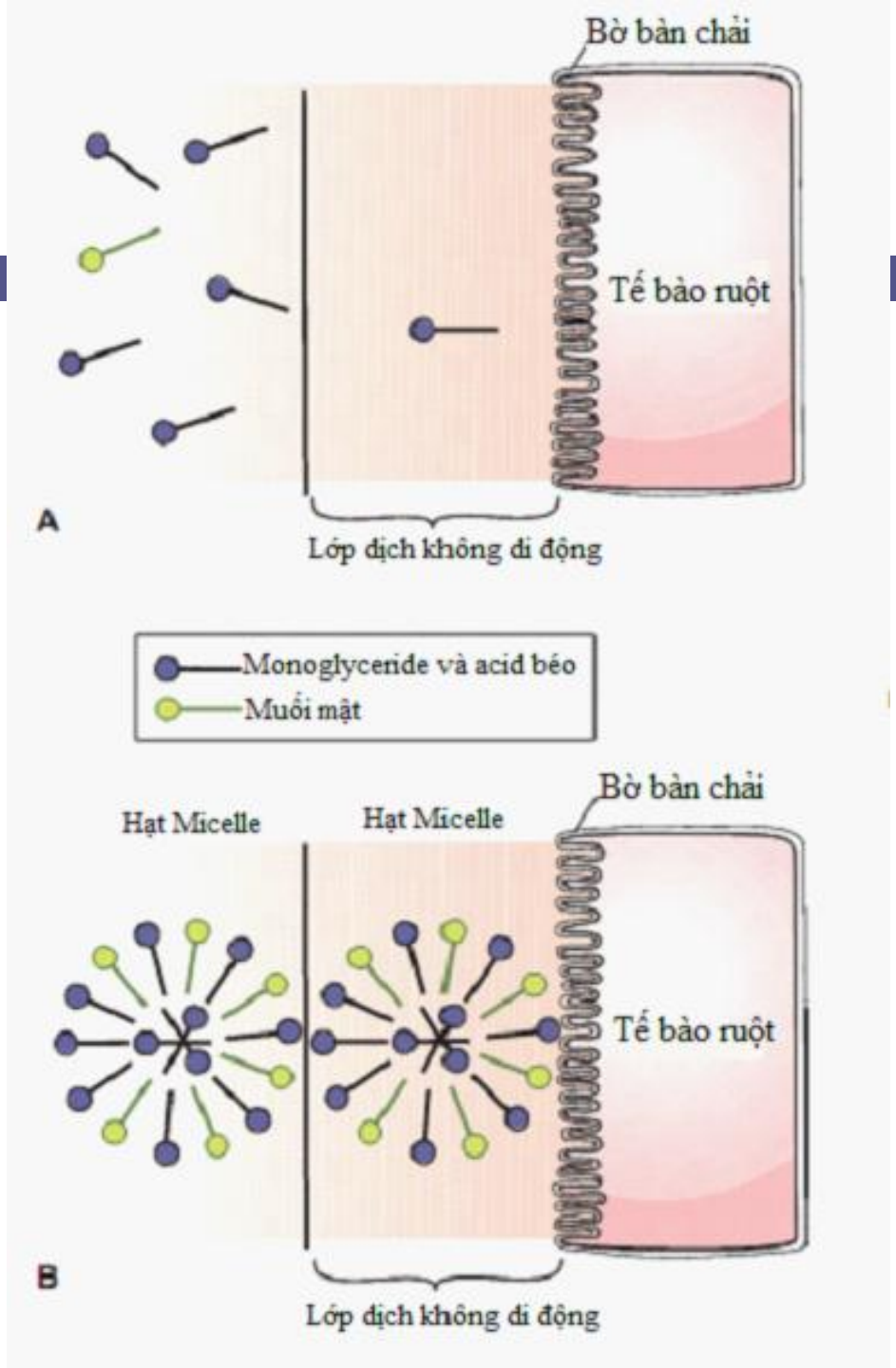

Pancreatic juice
Enterokinase
Trypsinogen
Trypsin
Trypsinogen
Trypsin
Chymotrypsinogen
Chymotrypsin
Proelastase
Elastase
Procarboxypeptidase A
Carboxy-
peptidase A
Procarboxypeptidase B
Carboxy-
peptidase B
Lumen
Epithelium

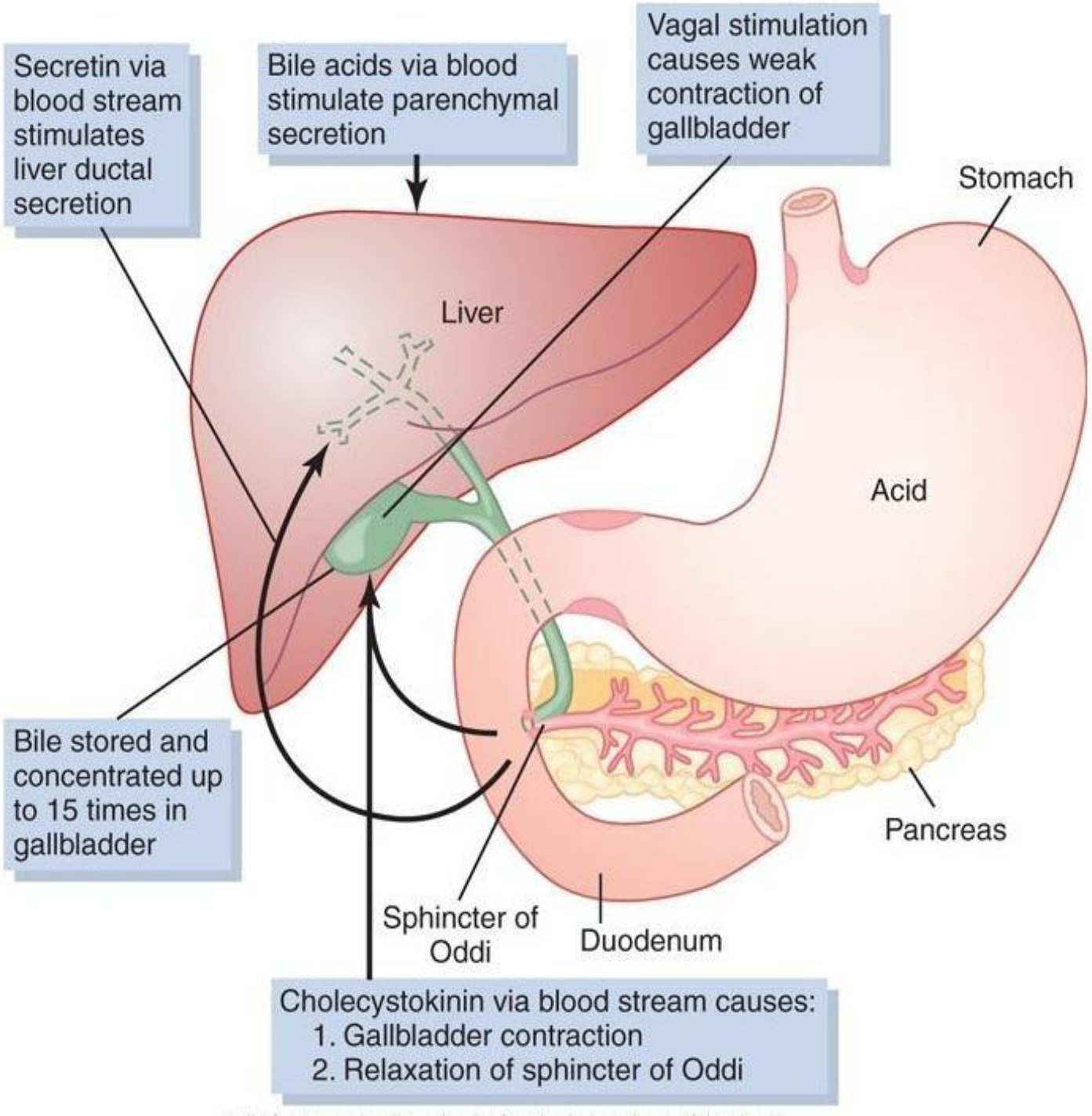

Acid from stomach releases secretin from wall of duodenum; fats and amino acids cause release of cholecystokinin
Common bile duct
Vagal stimulation releases enzymes into acini
Secretin and cholecystokinin absorbed into blood stream
Secretin causes copious secretion of pancreatic fluid and bicarbonate; cholecystokinin causes secretion of enzymes

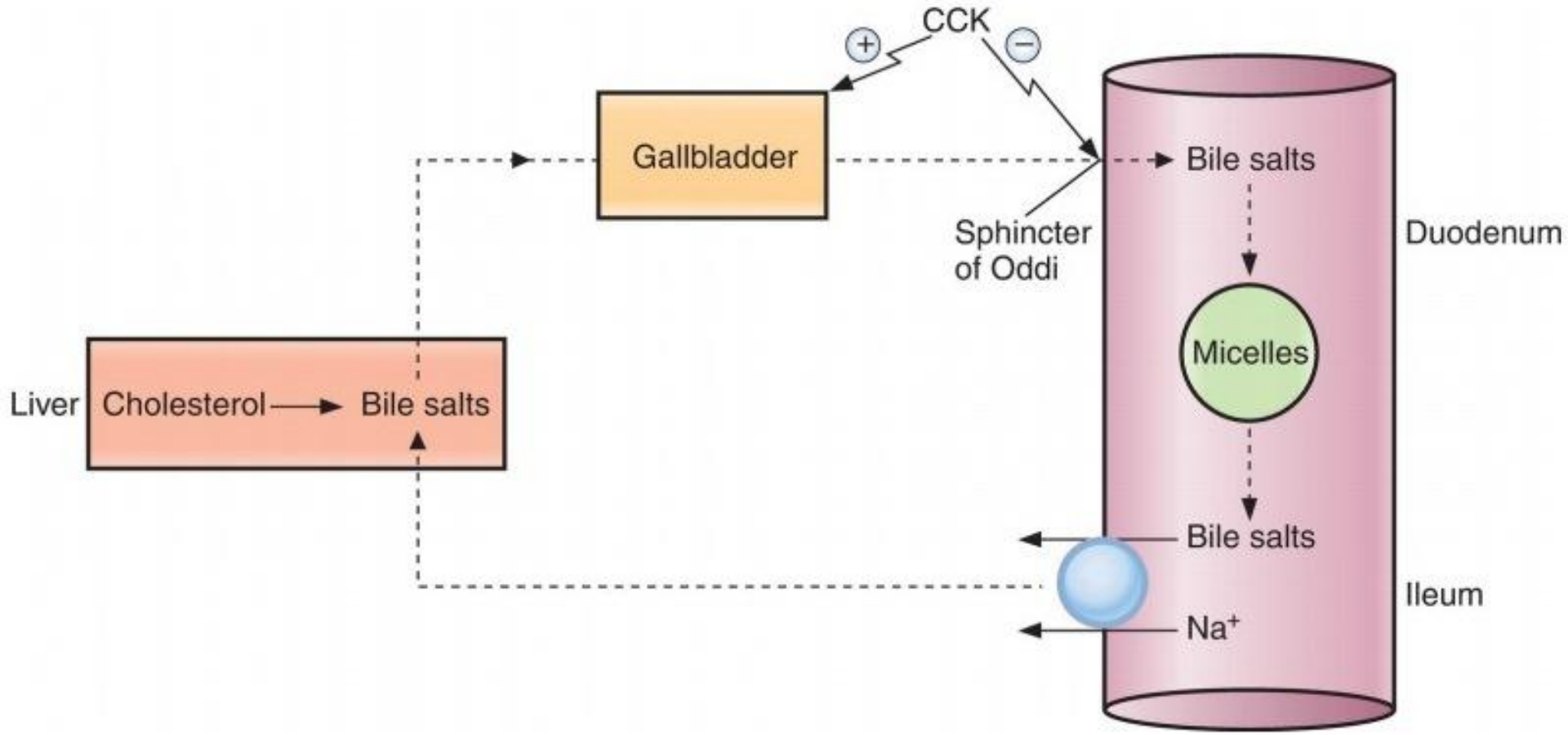
BÀI TIẾT MẬT


Central vein
Sinusoids
Liver cell plate
Space of Disse
Kupffer cell
Terminal lymphatics
Bile canaliculi
Lymphatic duct
Portal vein
Hepatic artery
Bile duct


From liver
Cystic duct
Right and left hepatic ducts from liver
Gallbladder
Common hepatic duct
Common bile duct
Pancreatic duct
Sphincter of Oddi
Duodenum

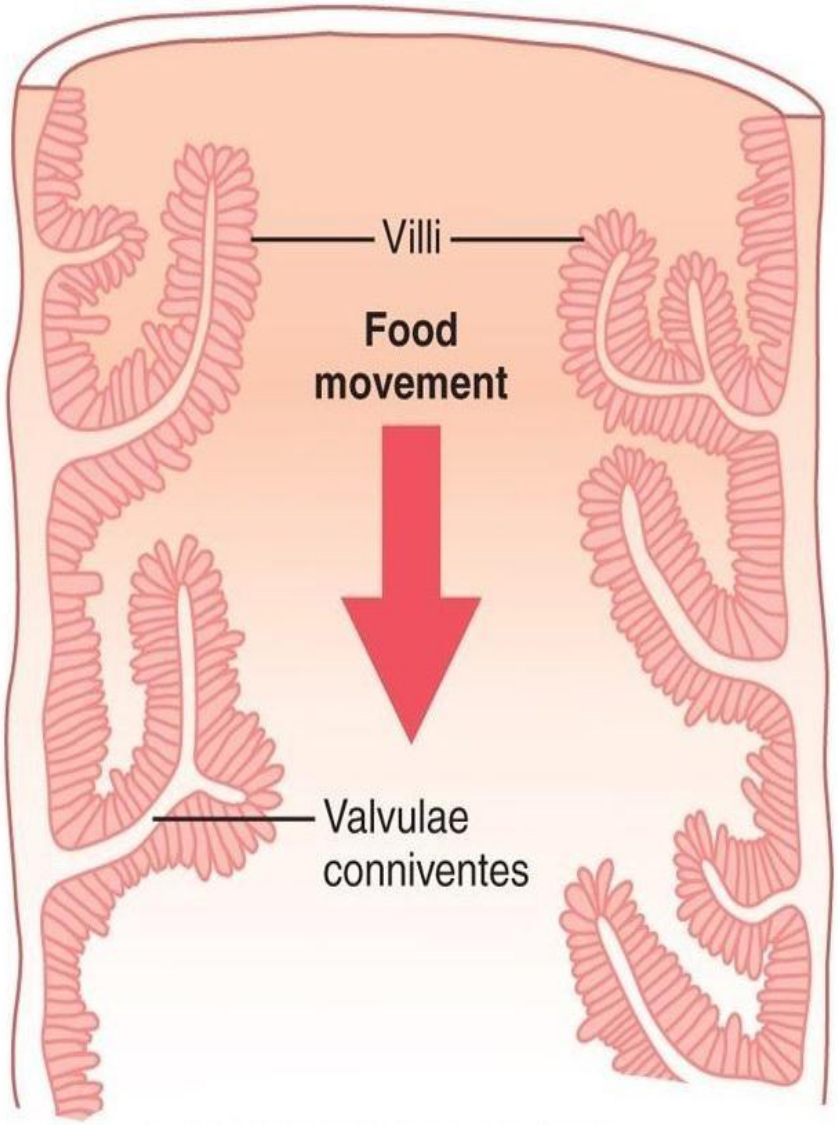

Bờ bàn chải
Tế bào ruột
A
Lớp dịch không di động
Monoglyceride và acid béo
Muối mật
Hạt Micelle
Hạt Micelle
Bờ bàn chải
Tế bào ruột
B
Lớp dịch không di động

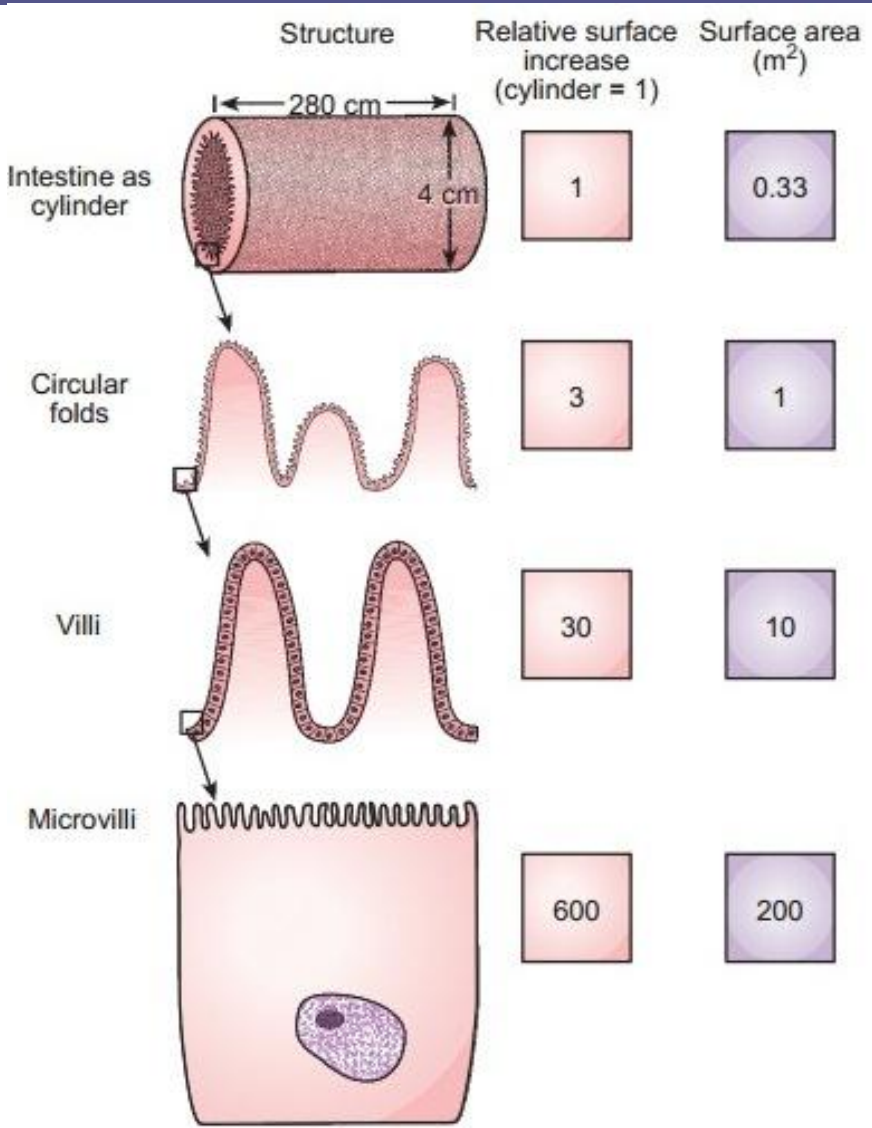

Secretin via blood stream stimulates liver ductal secretion
Bile acids via blood stimulate parenchymal secretion
Vagal stimulation causes weak contraction of gallbladder
Stomach
Liver
Acid
Bile stored and concentrated up to 15 times in gallbladder
Pancreas
Sphincter of Oddi
Duodenum
Cholecystokinin via blood stream causes:
1. Gallbladder contraction
2. Relaxation of sphincter of Oddi


CCK
+
−
Gallbladder
Bile salts
Sphincter
of Oddi
Duodenum
Micelles
Liver
Cholesterol
Bile salts
Bile salts
Ileum
Na+

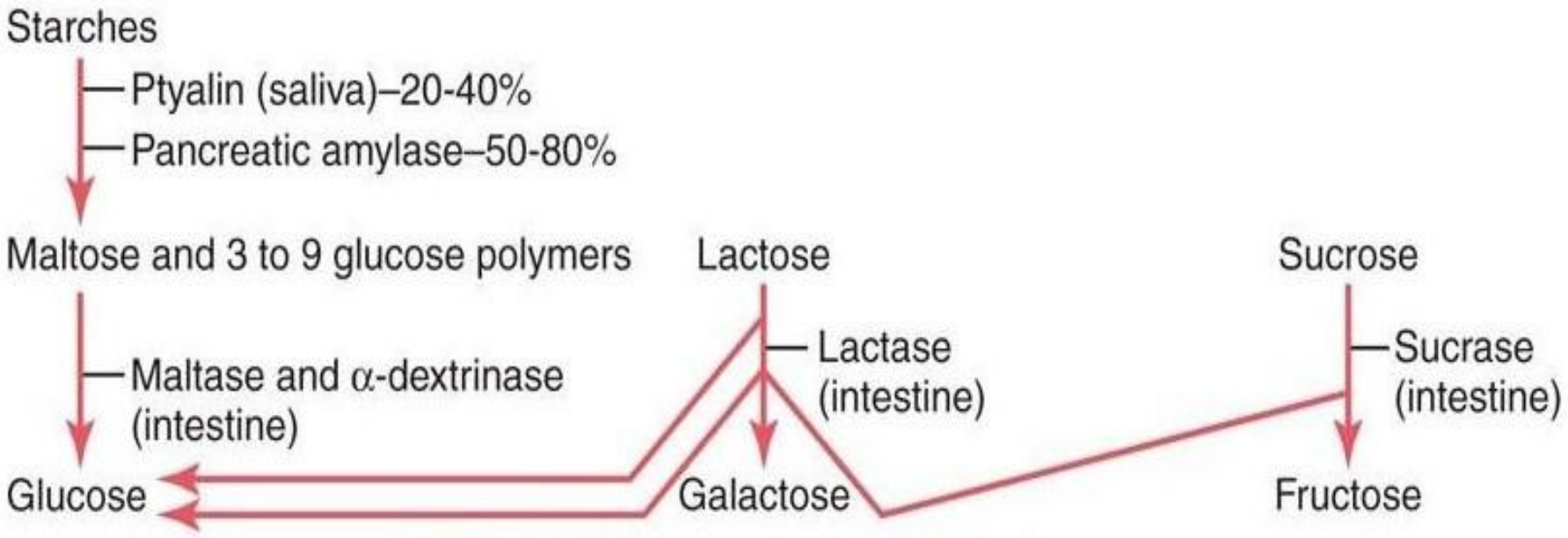
HOẠT ĐỘNG TIÊU HÓA – HẤP THU

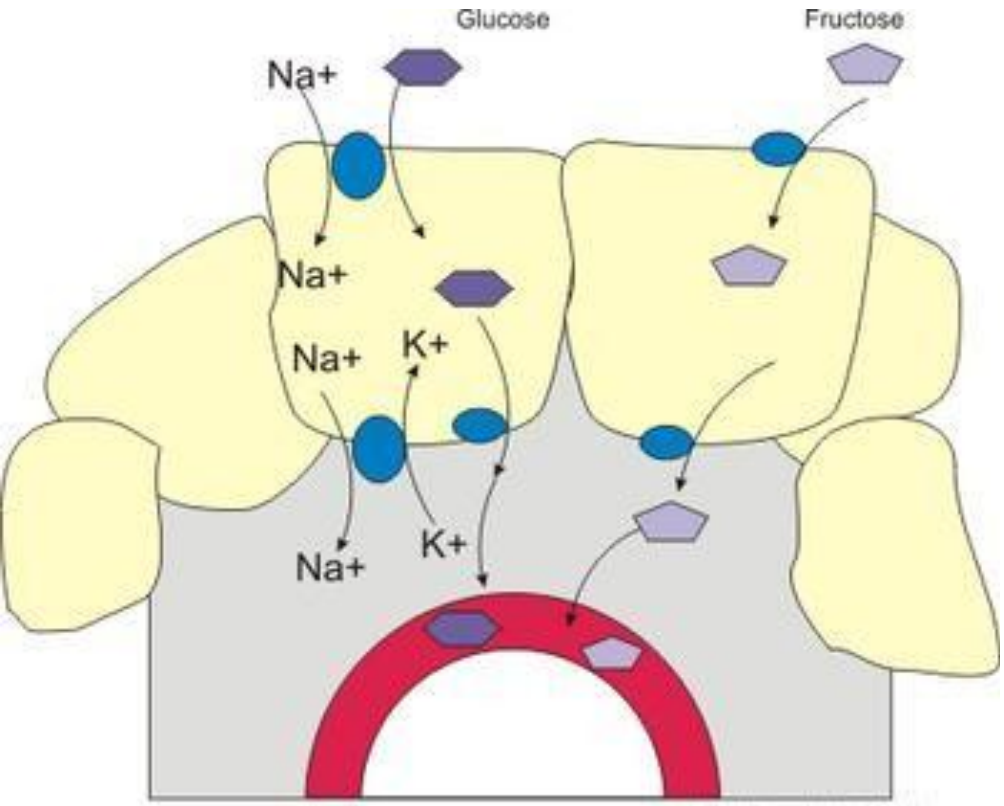
ĐẠI CƯƠNG

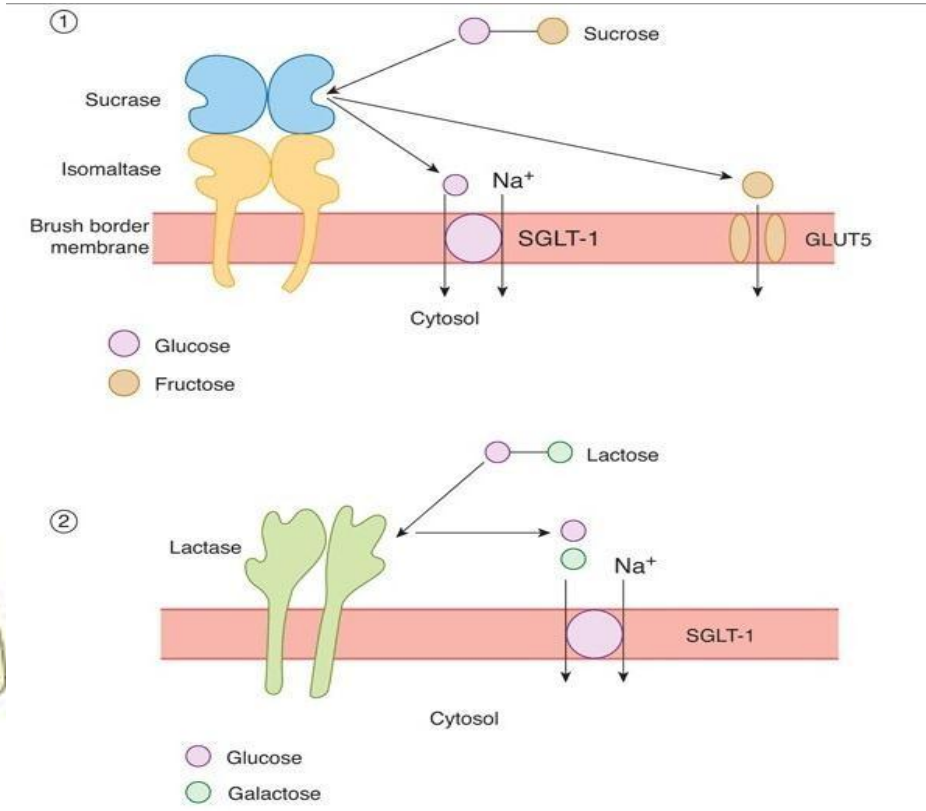

Villi
Food movement
Valvulae conniventes


Structure
Relative surface increase (cylinder = 1)
Surface area (m^2)
280 cm
4 cm
Intestine as cylinder
1
0.33
Circular folds
3
1
Villi
30
10
Microvilli
600
200

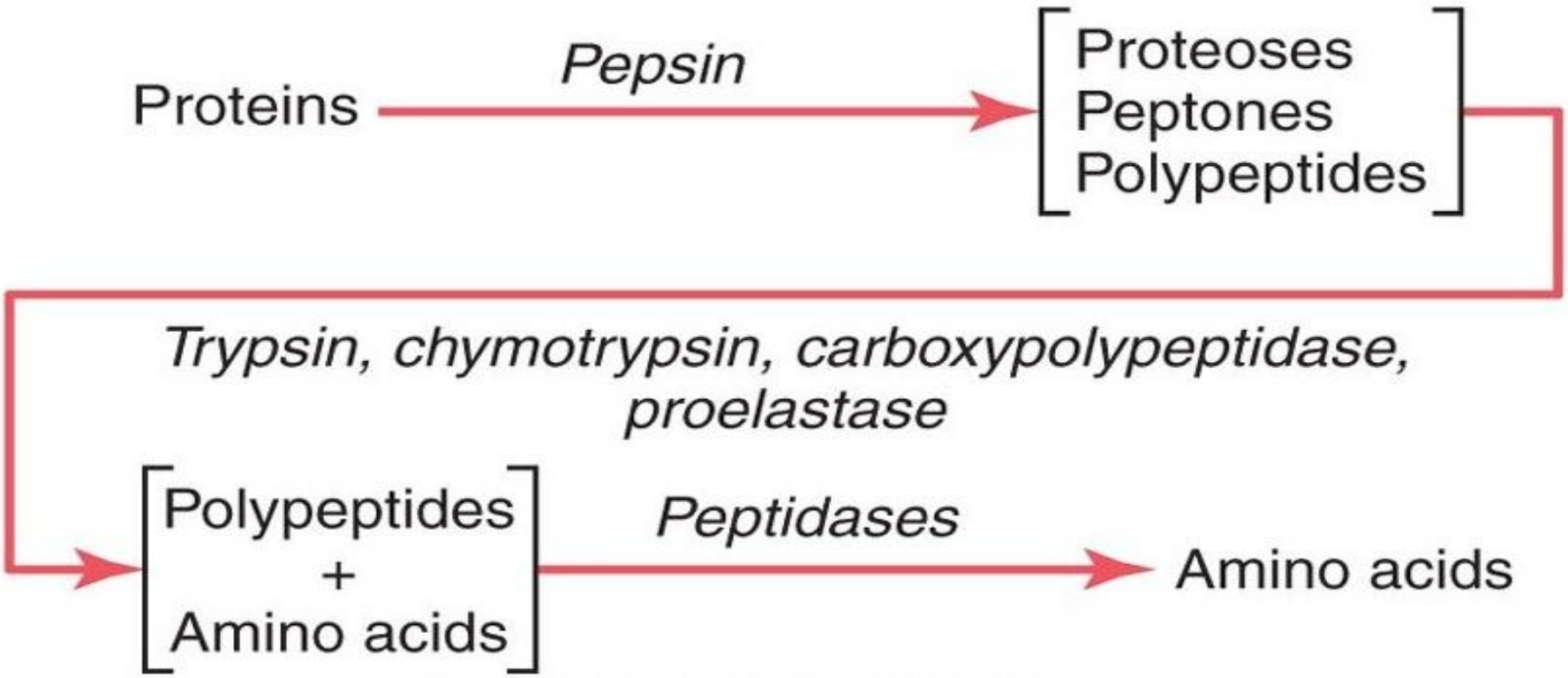
CARBOHYDRATES

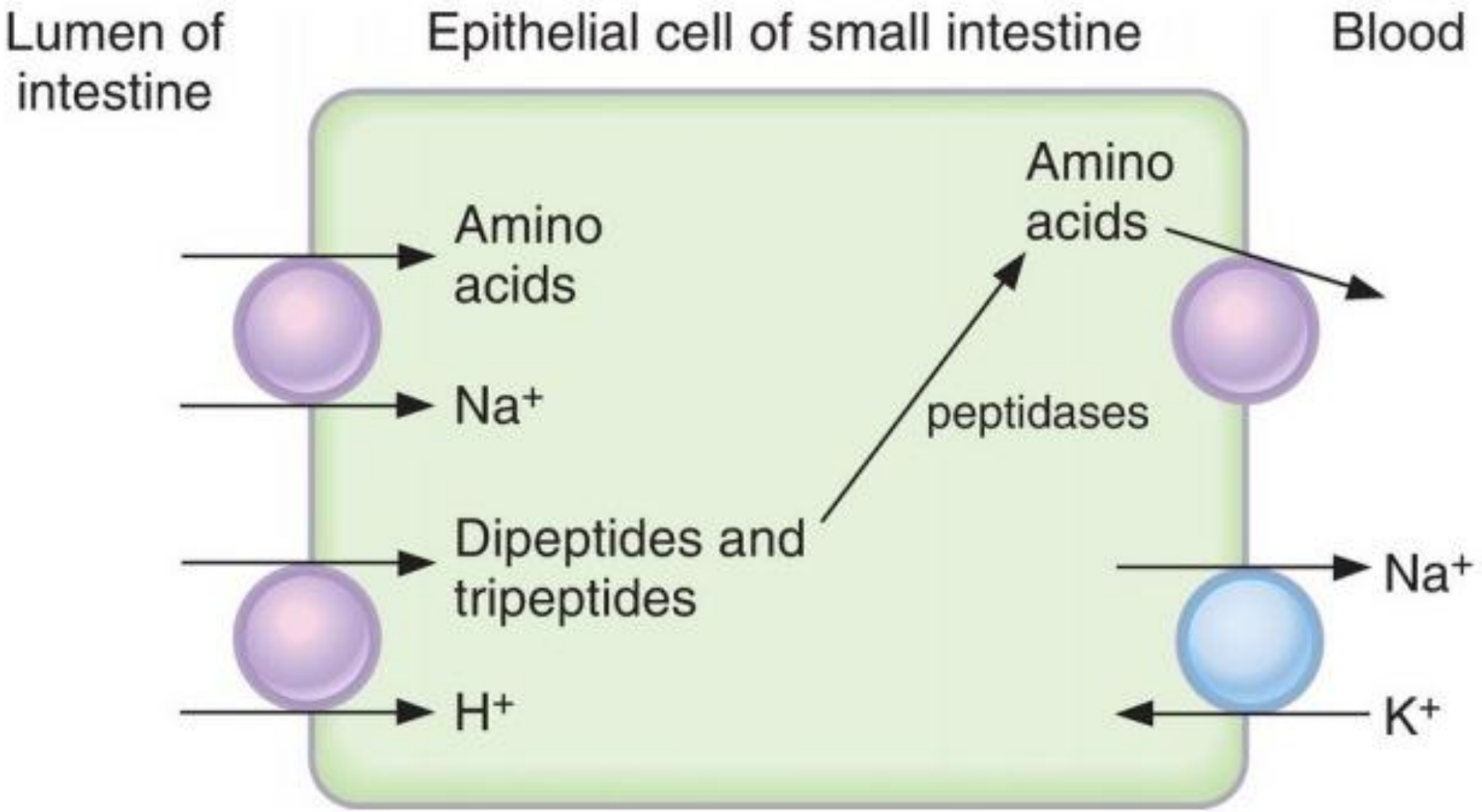


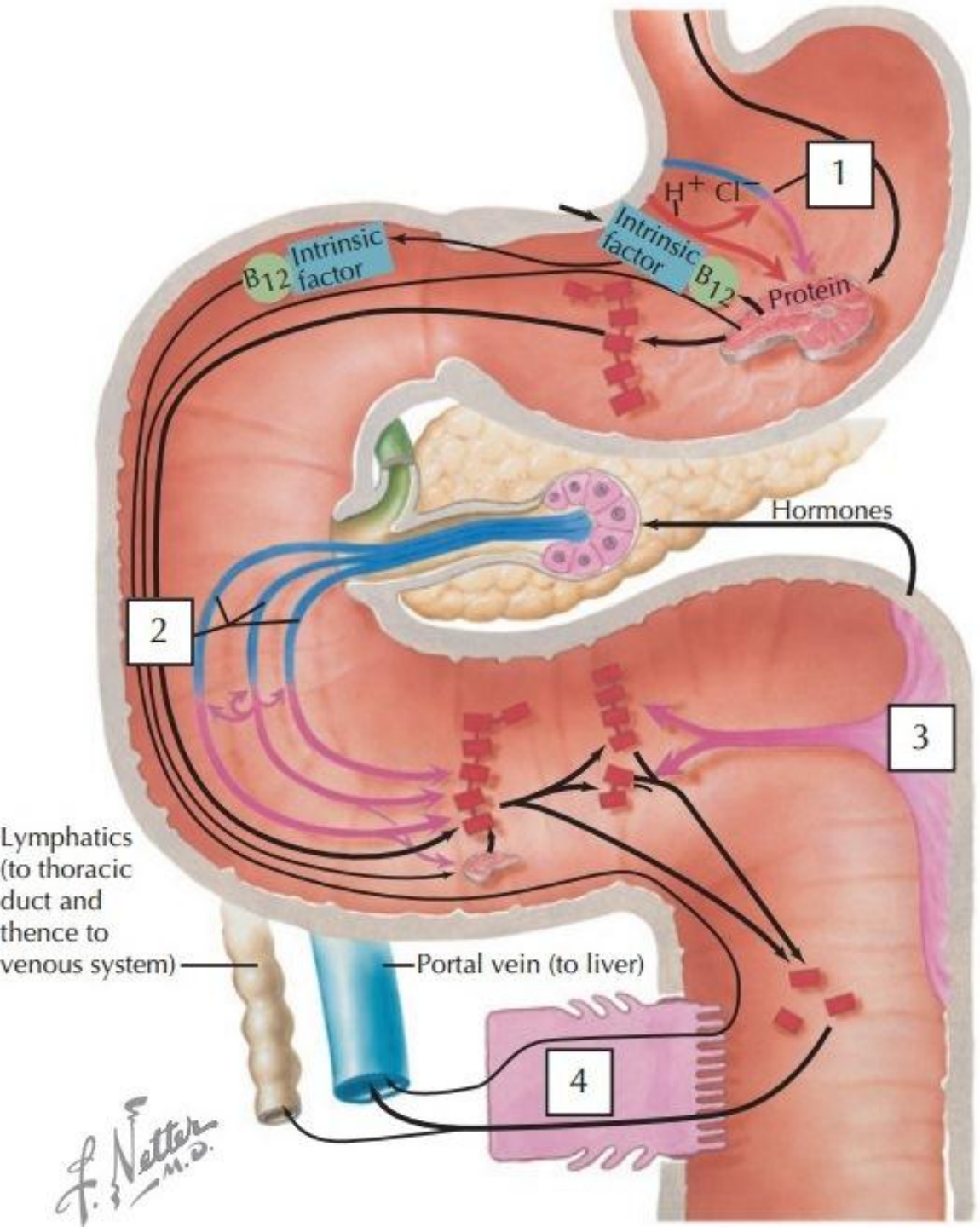

Glucose
Fructose
Na+
Na+
Na+
K+
Na+
K+

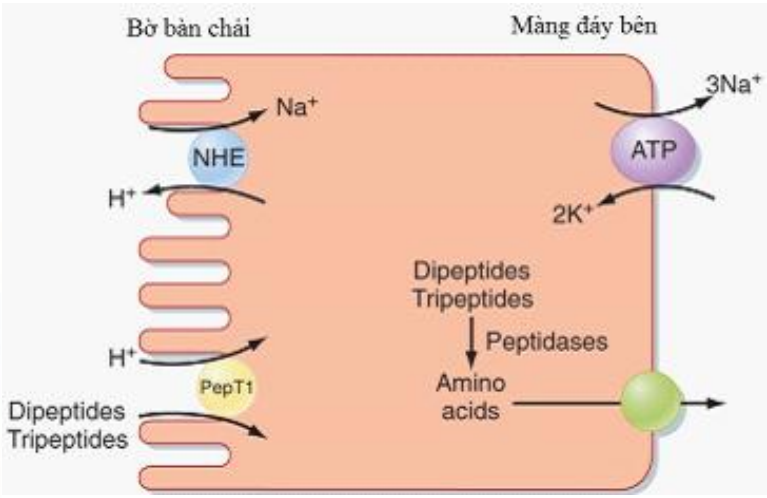

①
Sucrose
Sucrase
Isomaltase
Na+
Brush border membrane
SGLT-1
GLUT5
Cytosol
Glucose
Fructose
②
Lactose
Lactase
Na+
SGLT-1
Cytosol
Glucose
Galactose

PROTEIN

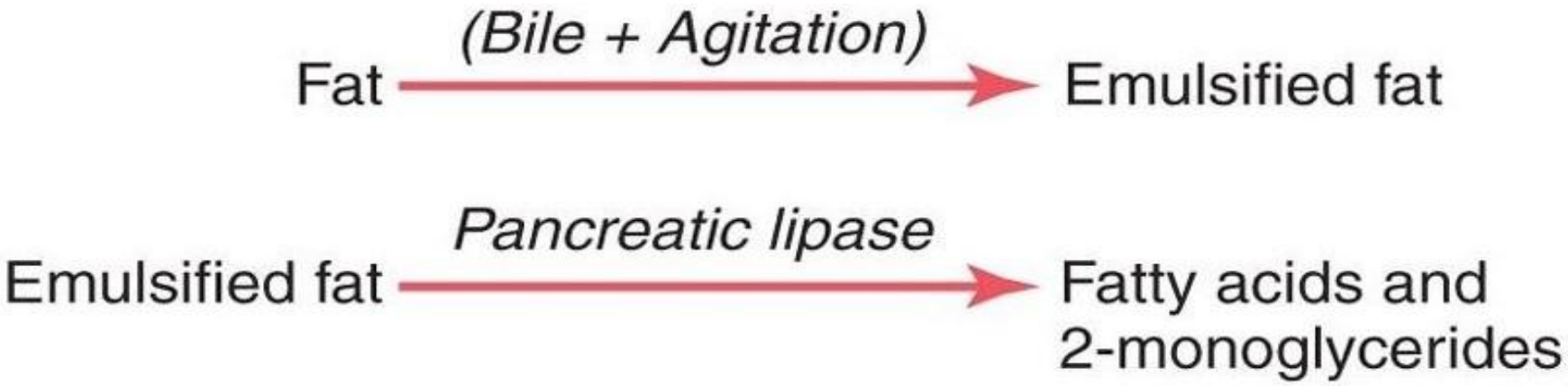

Proteins
Pepsin
Proteoses
Peptones
Polypeptides
Trypsin, chymotrypsin, carboxypolypeptidase,
proelastase
Polypeptides
+
Amino acids
Peptidases
Amino acids

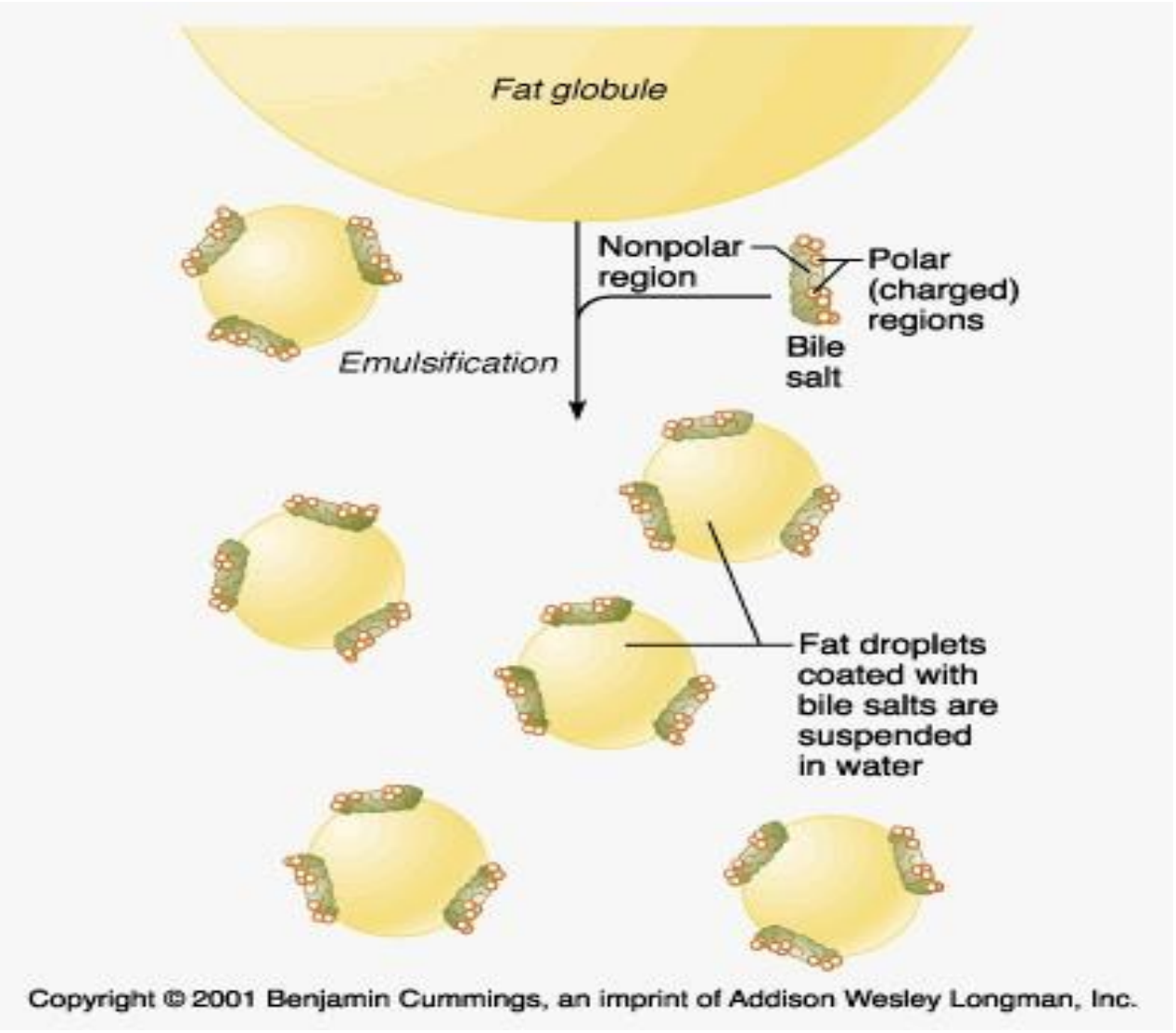

Lumen of intestine
Epithelial cell of small intestine
Blood
Amino acids
Na+
Dipeptides and tripeptides
H+
peptidases
Amino acids
Na+
K+


1
H^+ Cl^-
Intrinsic factor
B_{12}
Intrinsic factor
B_{12}
Protein
Hormones
2
3
4
Lymphatics (to thoracic duct and thence to venous system)
Portal vein (to liver)


Bờ bàn chải
Màng đáy bên
Na^+
NHE
H^+
H^+
PepT1
Dipeptides
Tripeptides
$3Na^+$
ATP
$2K^+$
Dipeptides
Tripeptides
Peptidases
Amino acids

LIPID


(Bile + Agitation)
Fat
Emulsified fat
Pancreatic lipase
Emulsified fat
Fatty acids and
2-monoglycerides



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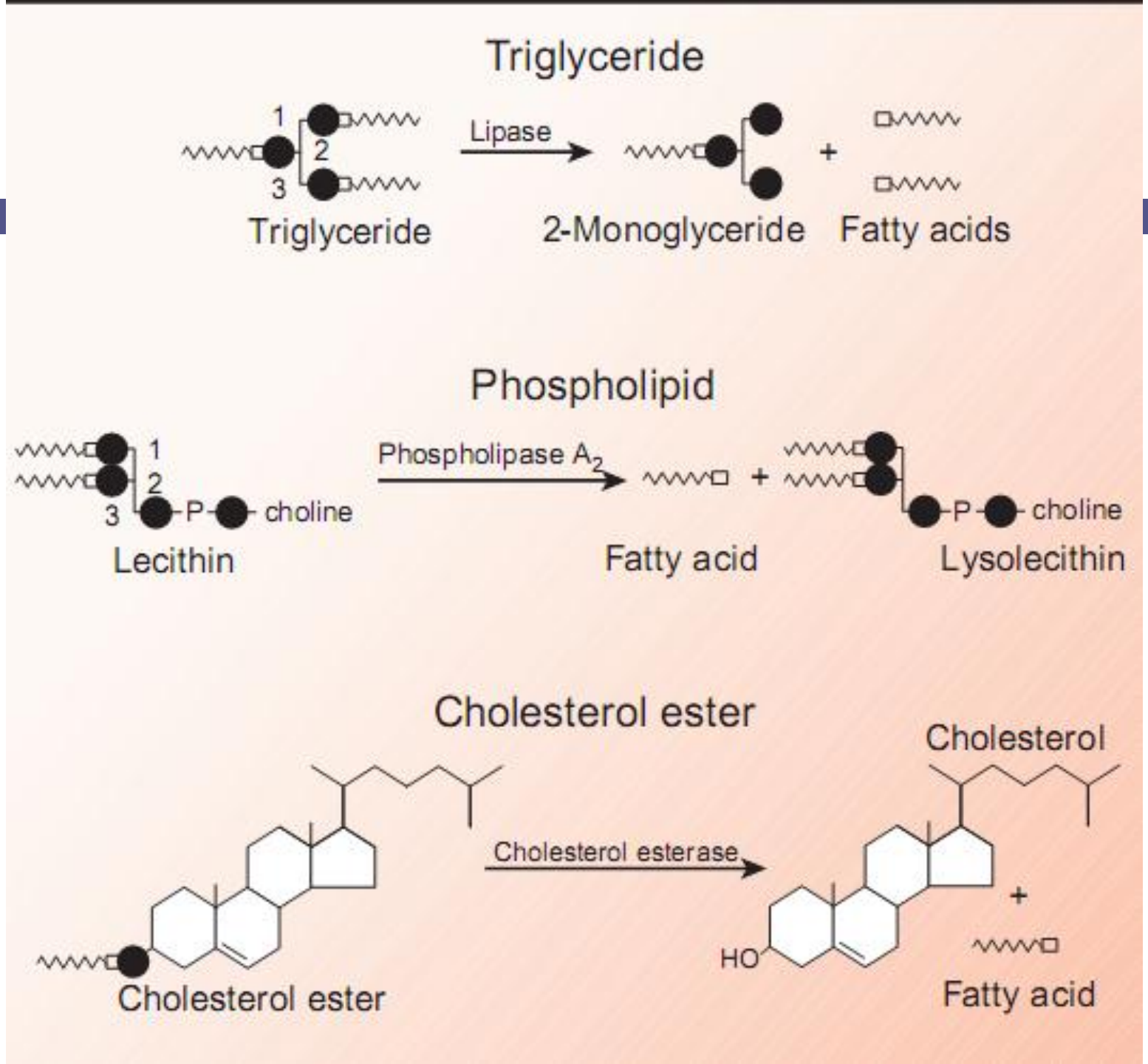
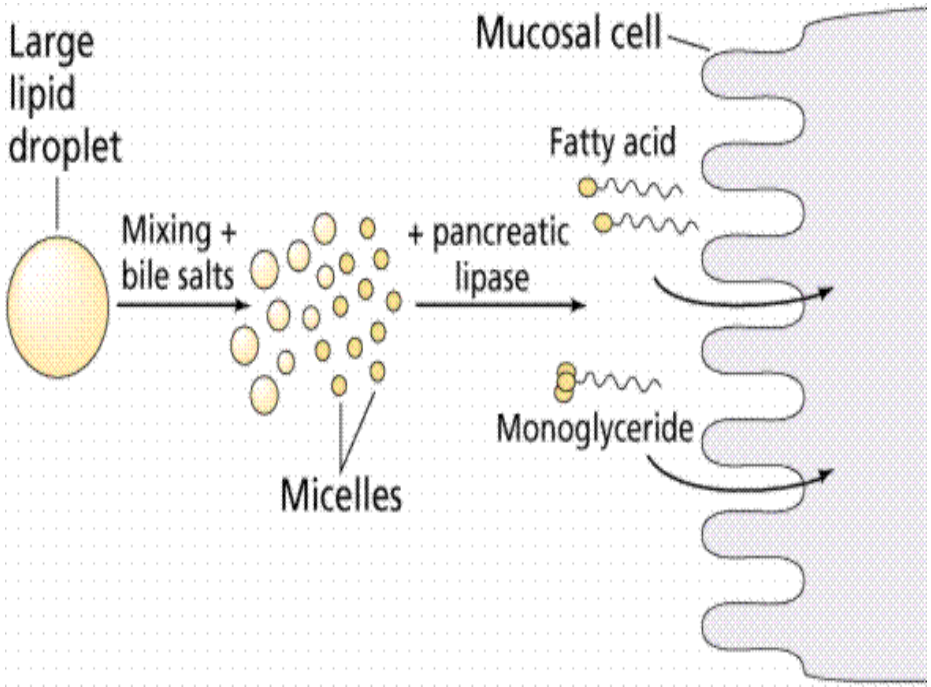
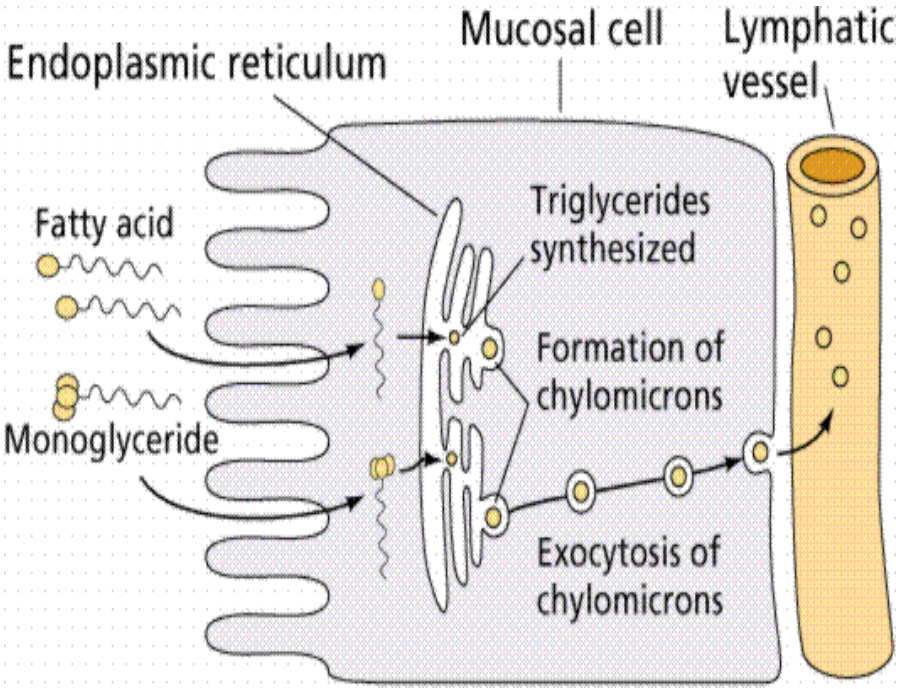
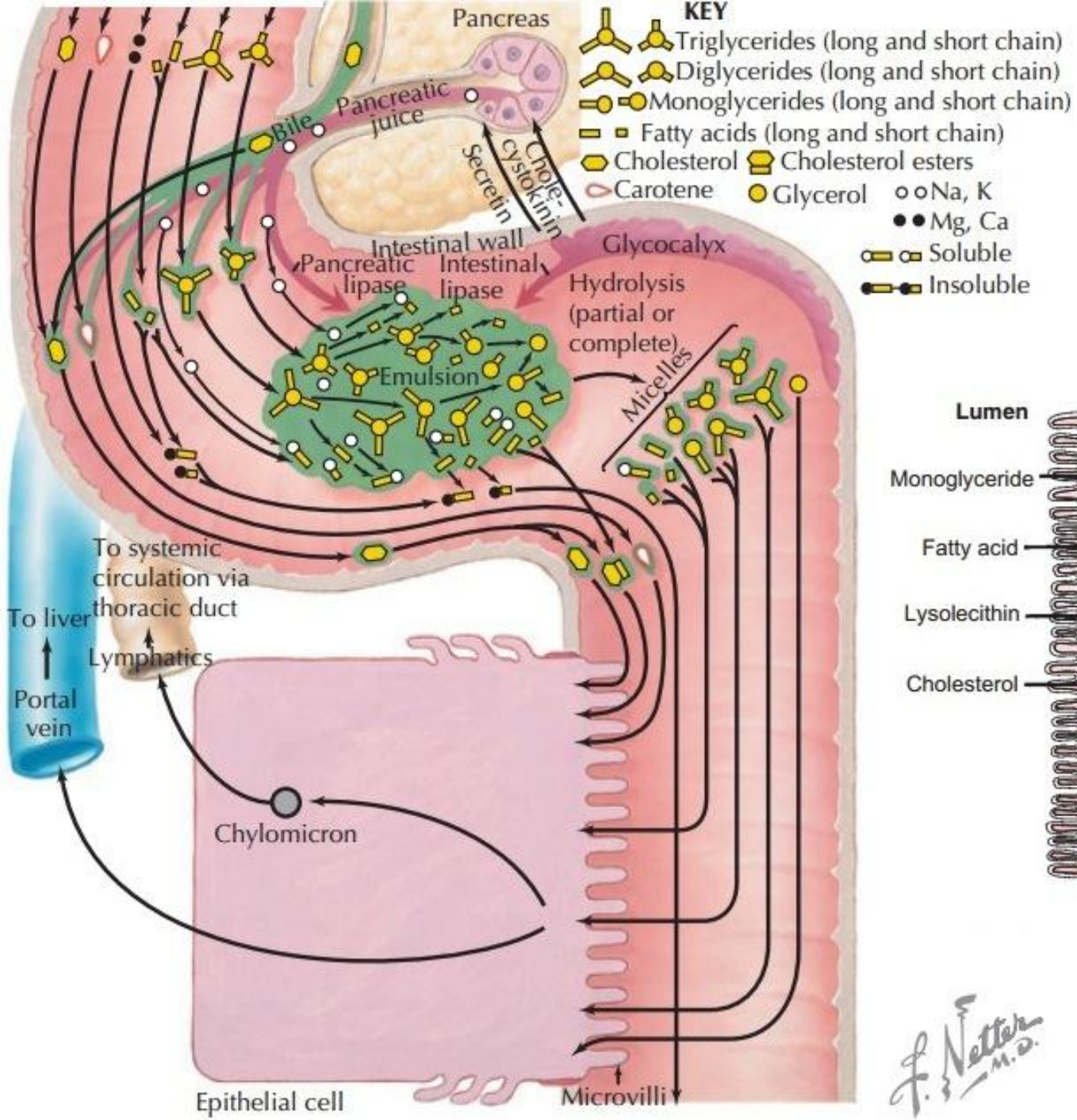
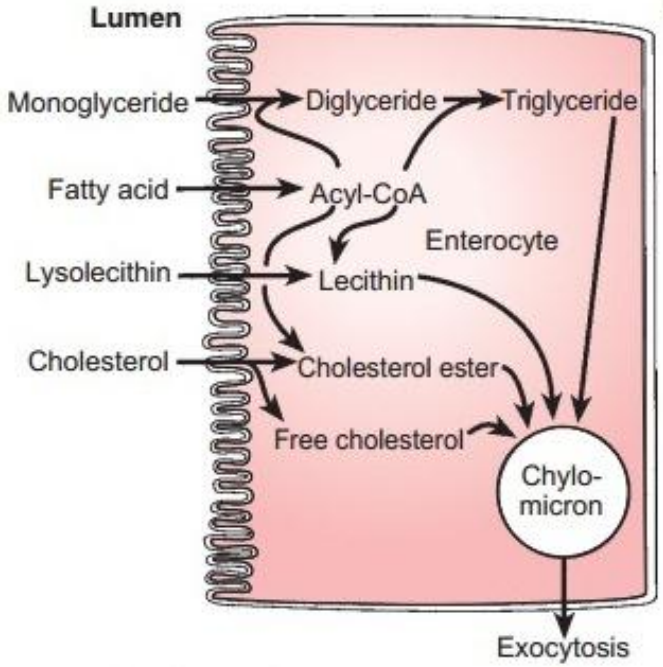

Triglyceride
1
2
3
Lipase
+
Triglyceride
2-Monoglyceride
Fatty acids
Phospholipid
1
2
3
P
choline
Phospholipase A2
+
P
choline
Lecithin
Fatty acid
Lysolecithin
Cholesterol ester
Cholesterol
Cholesterol esterase
+
HO
Cholesterol ester
Fatty acid


Large lipid droplet
Mixing + bile salts
Micelles
+ pancreatic lipase
Mucosal cell
Fatty acid
Monoglyceride


Endoplasmic reticulum
Mucosal cell
Lymphatic vessel
Fatty acid
Monoglyceride
Triglycerides synthesized
Formation of chylomicrons
Exocytosis of chylomicrons


Pancreas
KEY
Triglycerides (long and short chain)
Diglycerides (long and short chain)
Monoglycerides (long and short chain)
Fatty acids (long and short chain)
Cholesterol
Cholesterol esters
Carotene
Glycerol
Na, K
Mg, Ca
Soluble
Insoluble
Bile
Pancreatic juice
Secretin
Cholecystokinin
Intestinal wall
Glycocalyx
Pancreatic lipase
Intestinal lipase
Hydrolysis (partial or complete)
Emulsion
Micelles
To systemic circulation via thoracic duct
To liver
Lymphatics
Portal vein
Chylomicron
Epithelial cell
Microvilli


Lumen
Interstitial space
Monoglyceride
Diglyceride
Triglyceride
Fatty acid
Acyl-CoA
Enterocyte
Lysolecithin
Lecithin
Cholesterol
Cholesterol ester
Free cholesterol
Chylo-micron
Exocytosis

Nutrient	Digestion	Site of Absorption	Mechanism of Absorption
Carbohydrates	To monosaccharides (glucose, galactose, fructose)	Small intestine	Na^+-dependent cotransport (glucose, galactose) Facilitated diffusion (fructose)
Proteins	To amino acids, dipeptides, tripeptides	Small intestine	Na^+-dependent cotransport (amino acids) H^+-dependent cotransport (di- and tripeptides)
Lipids	To fatty acids, monoglycerides, cholesterol	Small intestine	Micelles form with bile salts in intestinal lumen Diffusion of fatty acids, monoglycerides, and cholesterol into cell Reesterification in cell to triglycerides and phospholipids Chylomicrons form in cell (requires apoprotein) and are transferred to lymph
Fat-soluble vitamins		Small intestine	Micelles with bile salts
Water-soluble vitamins Vitamin B_{12}		Small intestine Ileum of small intestine	Na^+-dependent cotransport Intrinsic factor–vitamin B_{12} complex
Bile acids		Ileum of small intestine	Na^+-dependent cotransport; recirculated to liver
Ca^{2+}		Small intestine	Vitamin D dependent (calbindin D-28K)
Fe^{2+}	Fe^{3+} is reduced to Fe^{2+}	Small intestine	Binds to apoferritin in cell Circulates in blood bound to transferrin

CẢM ƠN ĐÃ CHÚ Ý LẮNG NGHE