STOMACH

Figures in this ppt are from guyton, ganong, best & taylor, tortora and google images

Gross anatomy & function

J- shaped

Hollow muscular bag.

Volume- 1200-1500ml

It stores food, mixes with gastric juice & releases it in the intestine in controlled way

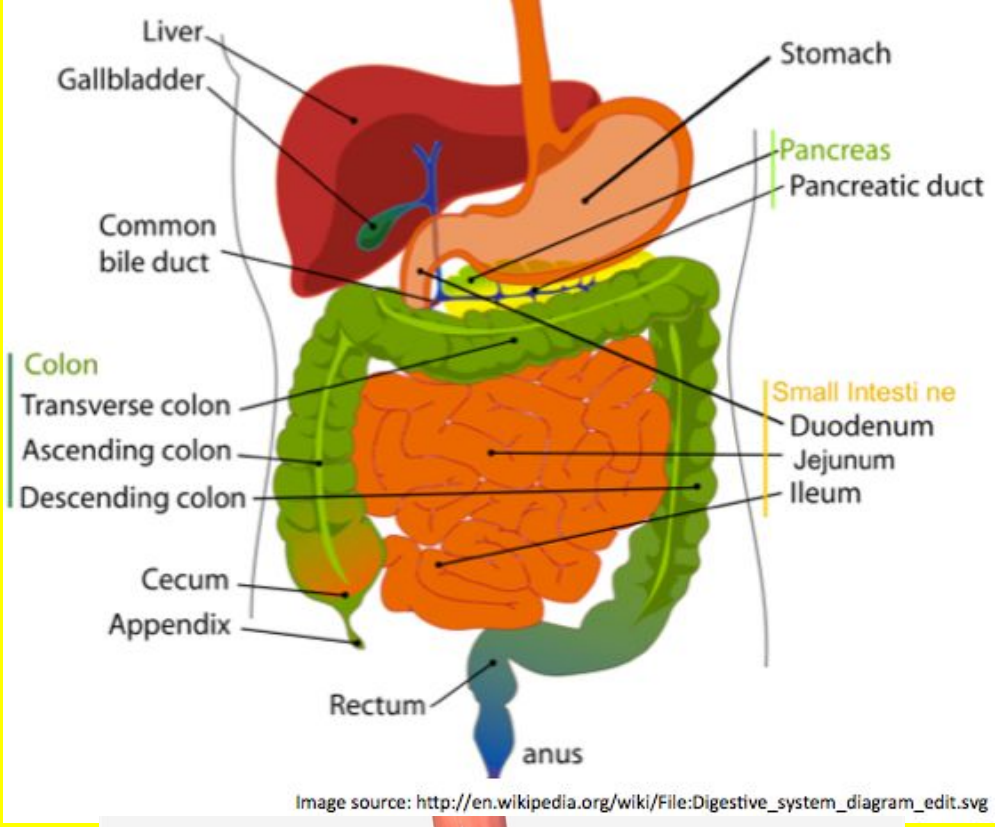
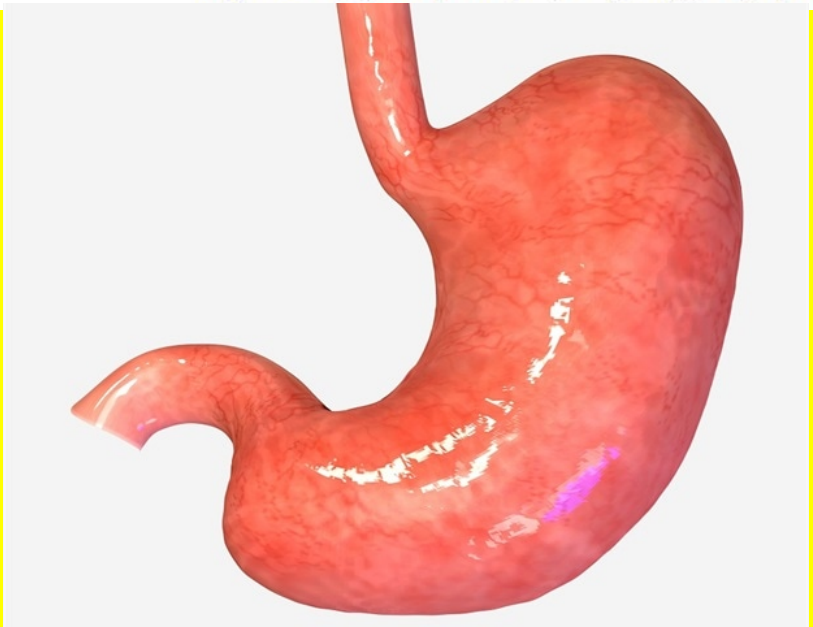


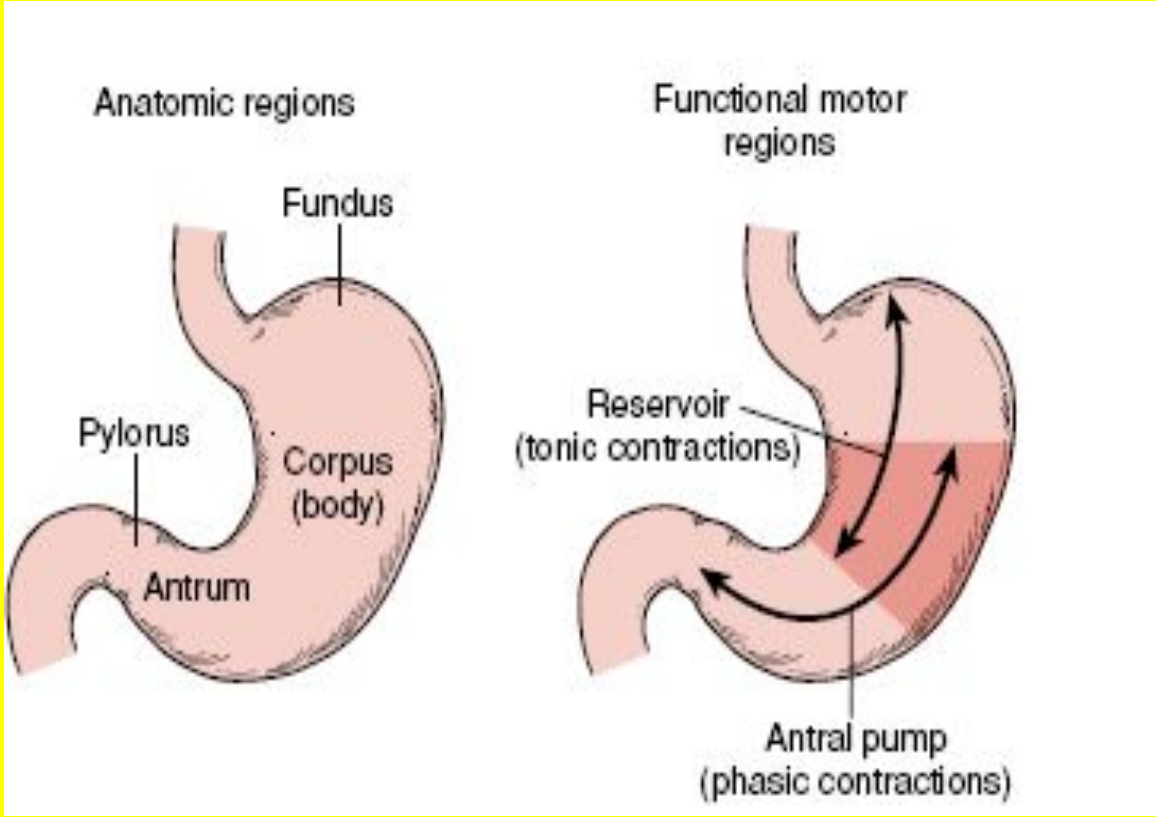
Image source: http://en.wikipedia.org/wiki/File:Digestive_system_diagram_edit.svg

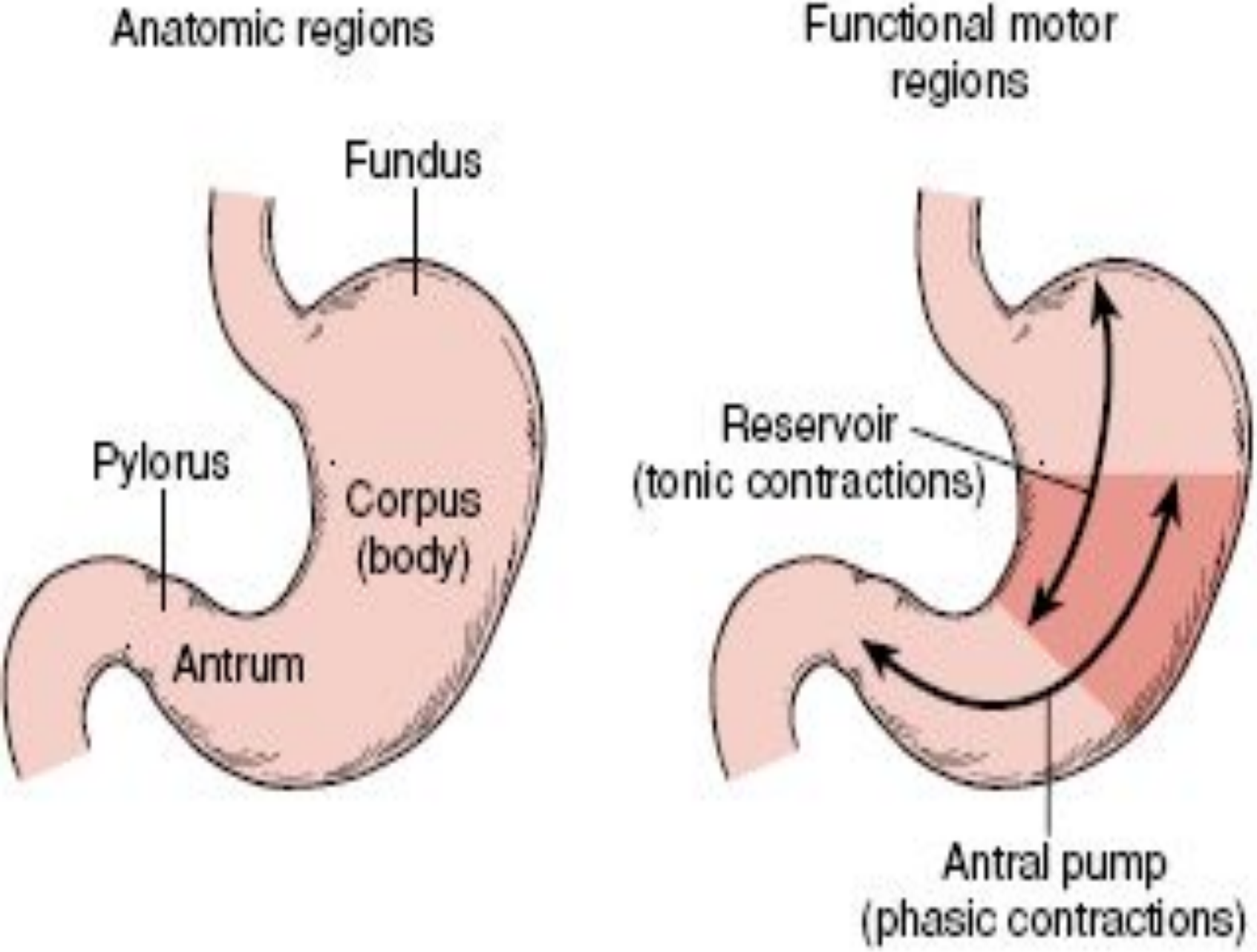


stomach

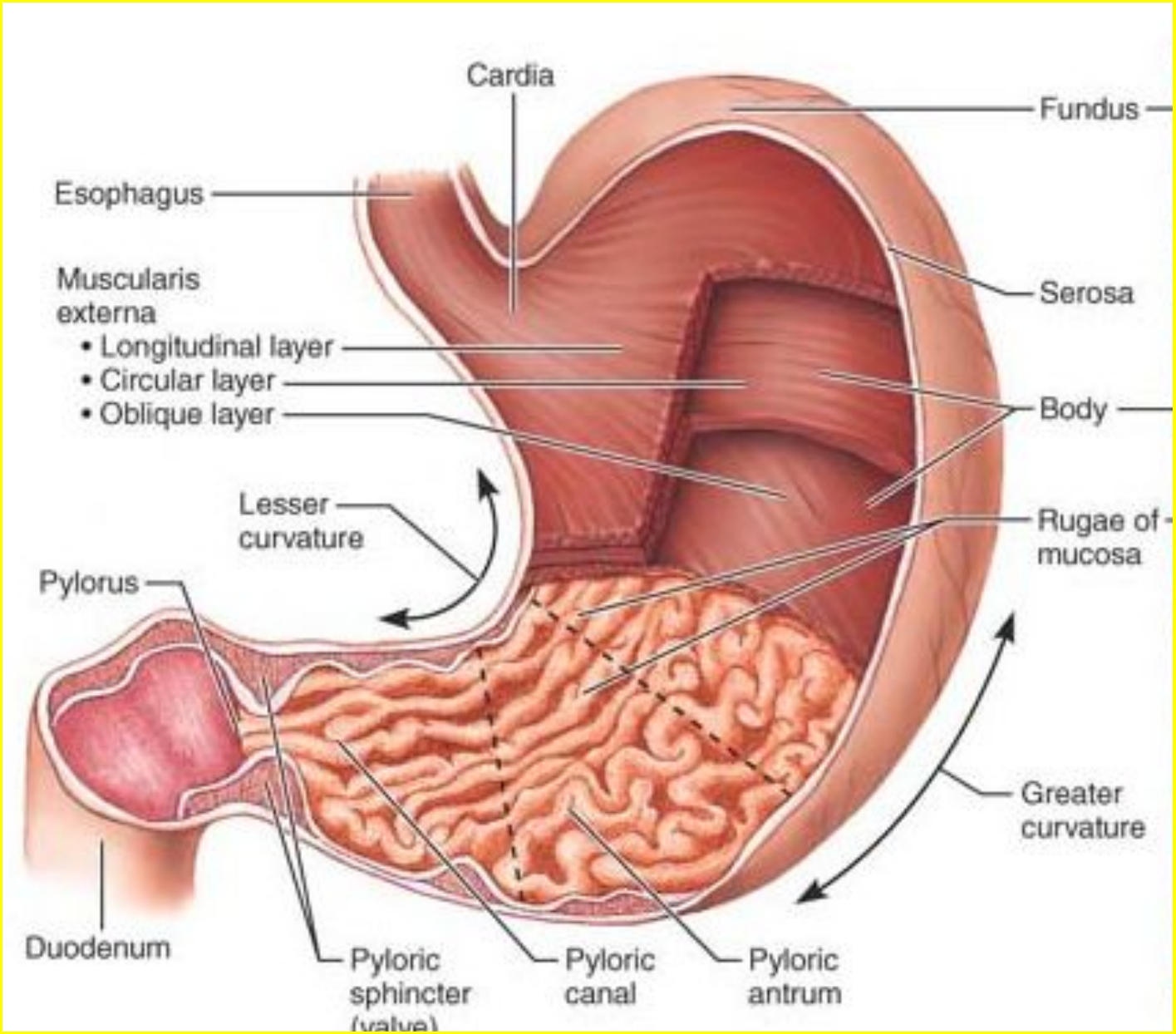
- **Anatomic division**
  - cardia
    - fundus
    - body
    - pylorus
- **Functional**

Orad & caudad stomach

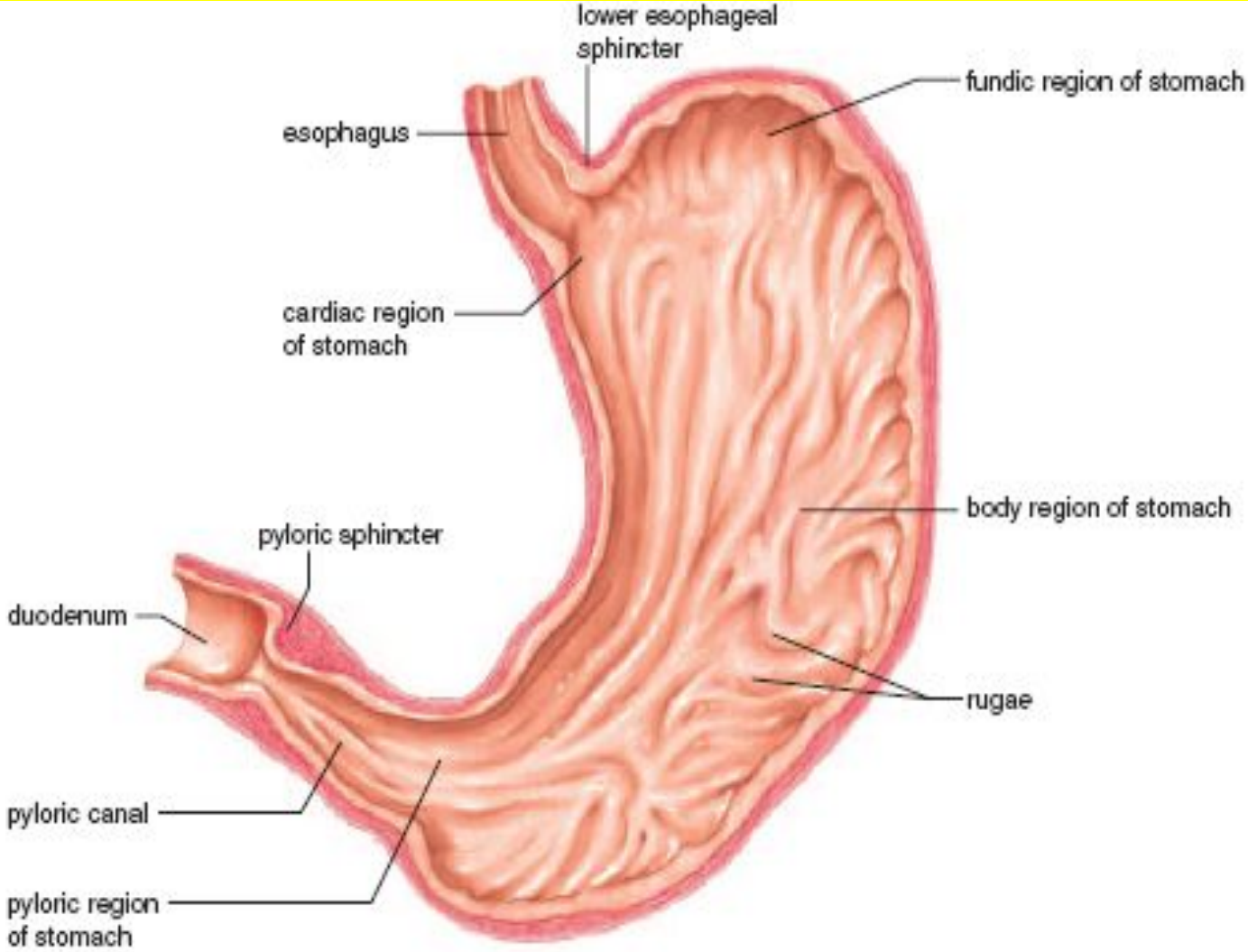



Anatomic regions
Fundus
Pylorus
Corpus
(body)
Antrum
Functional motor
regions
Reservoir
(tonic contractions)
Antral pump
(phasic contractions)

Extra layer of muscle-oblique



Mucosal folds
Rugae & gastric canal(magenstrasse)



FUNCTIONS OF STOMACH

1. **mechanical functions:**

   Receive food material and acts as reservoir

   Movements help in proper mixing of food with digestive juices and help to propel food into the duodenum.

2. **Secretory functions:**

   Secrete gastric juice , gastrin

3. **Digestive functions:**

   Protein into peptones

   Fats by gastric lipase to some extent.

4 Absorptive functions

Small amount of water, glucose & certain drugs absorbed from stomach

5. Excretory functions:

Certain toxins, alkaloids

6. Hemopoietic function:

intrinsic factor,

7.Protective:-HCl, Mucus & HCO_3^-

8. Reflex functions;

a.Gastrosalivary reflex

b.Gastroilial reflex

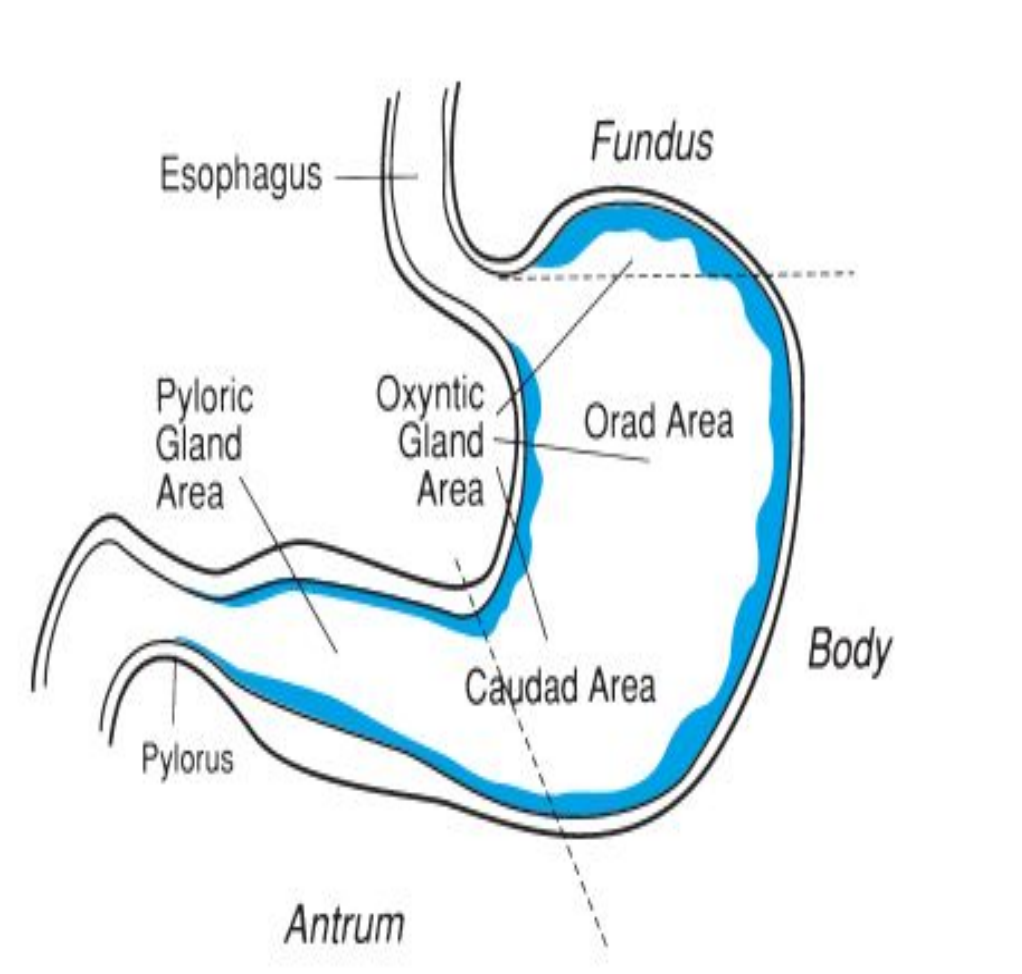
c.Gastrocolic reflex

Gastric glands are of three types:

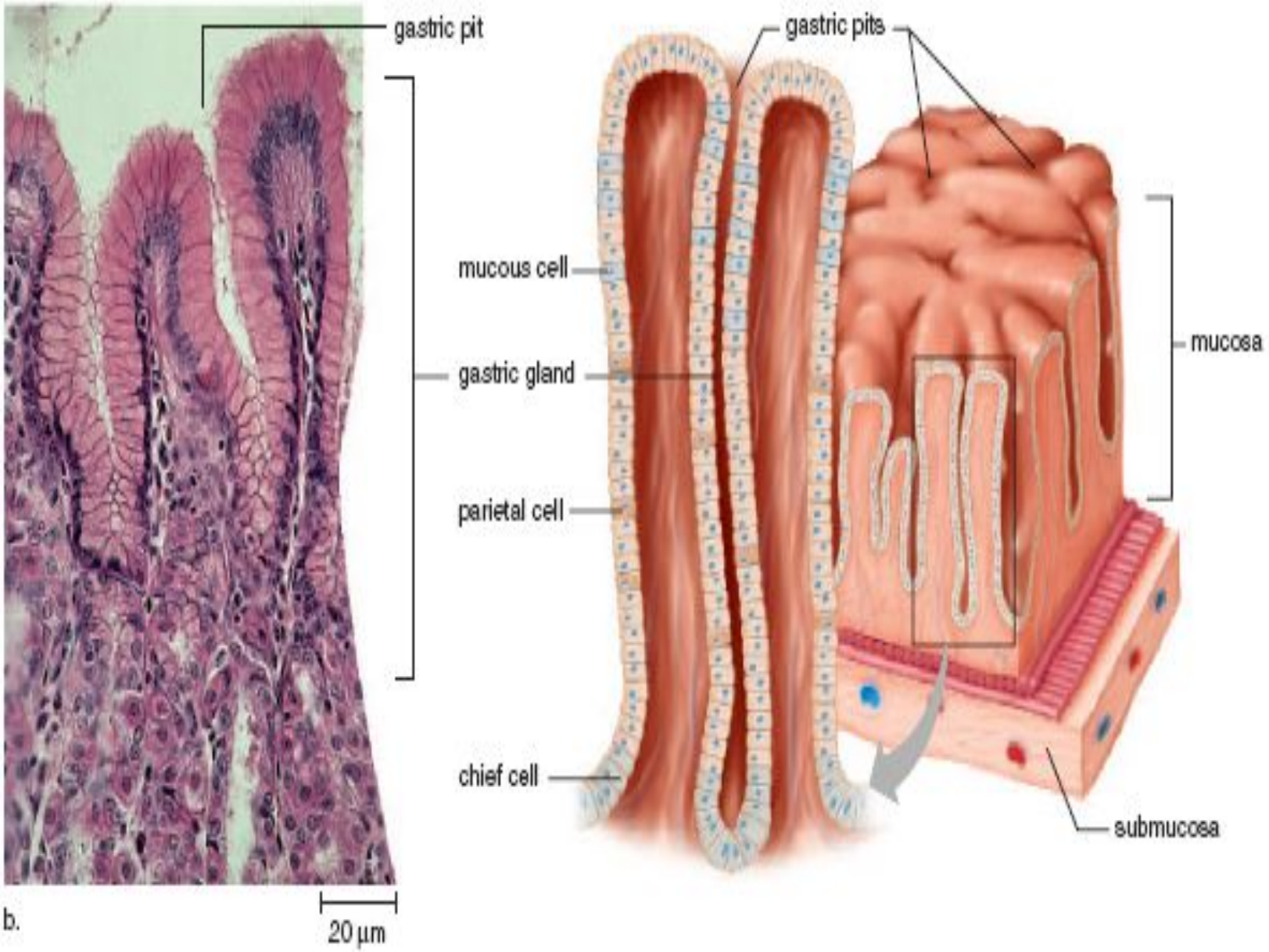
A. main gastric glands

B. cardiac glands

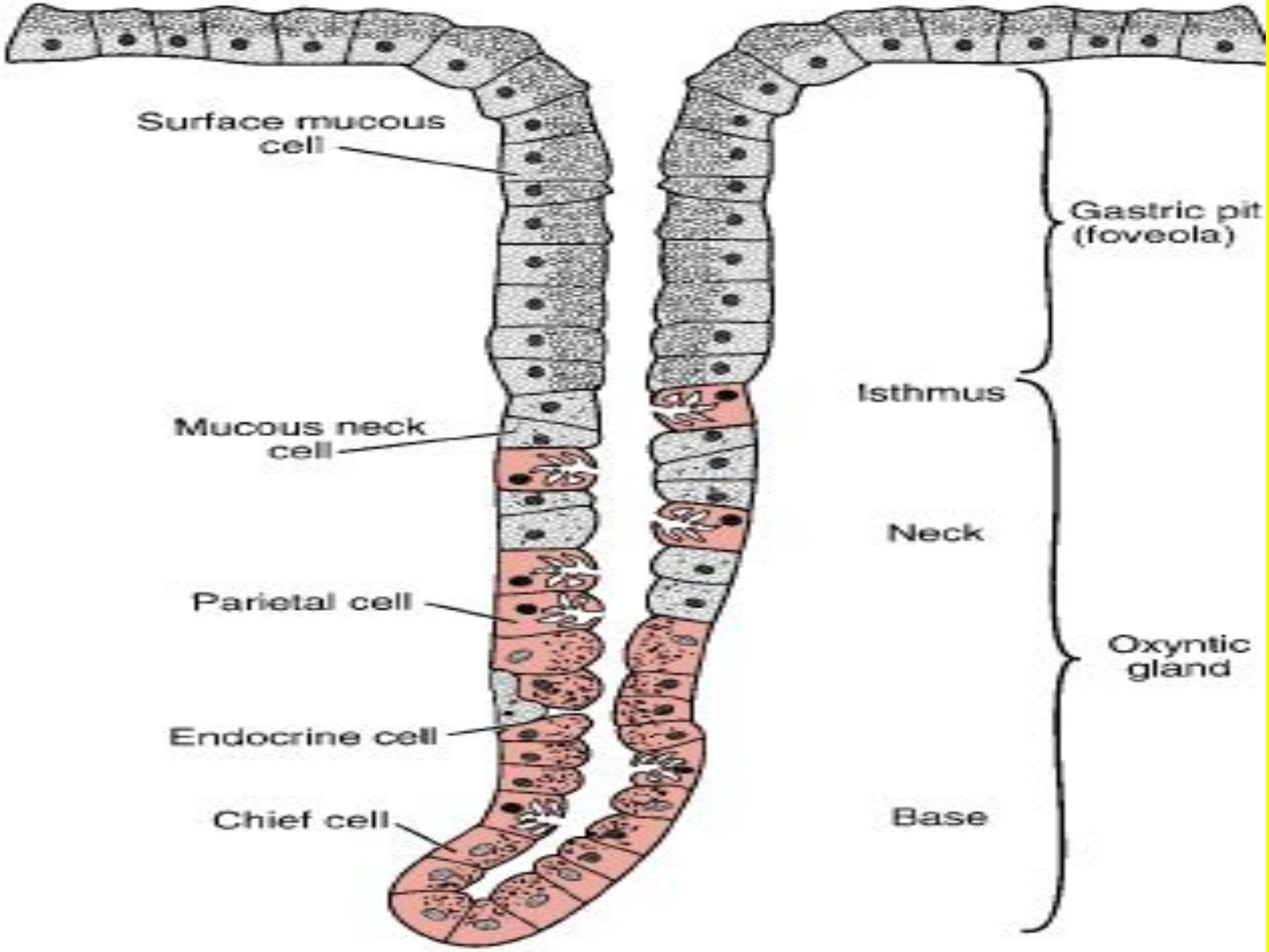
C. pyloric glands



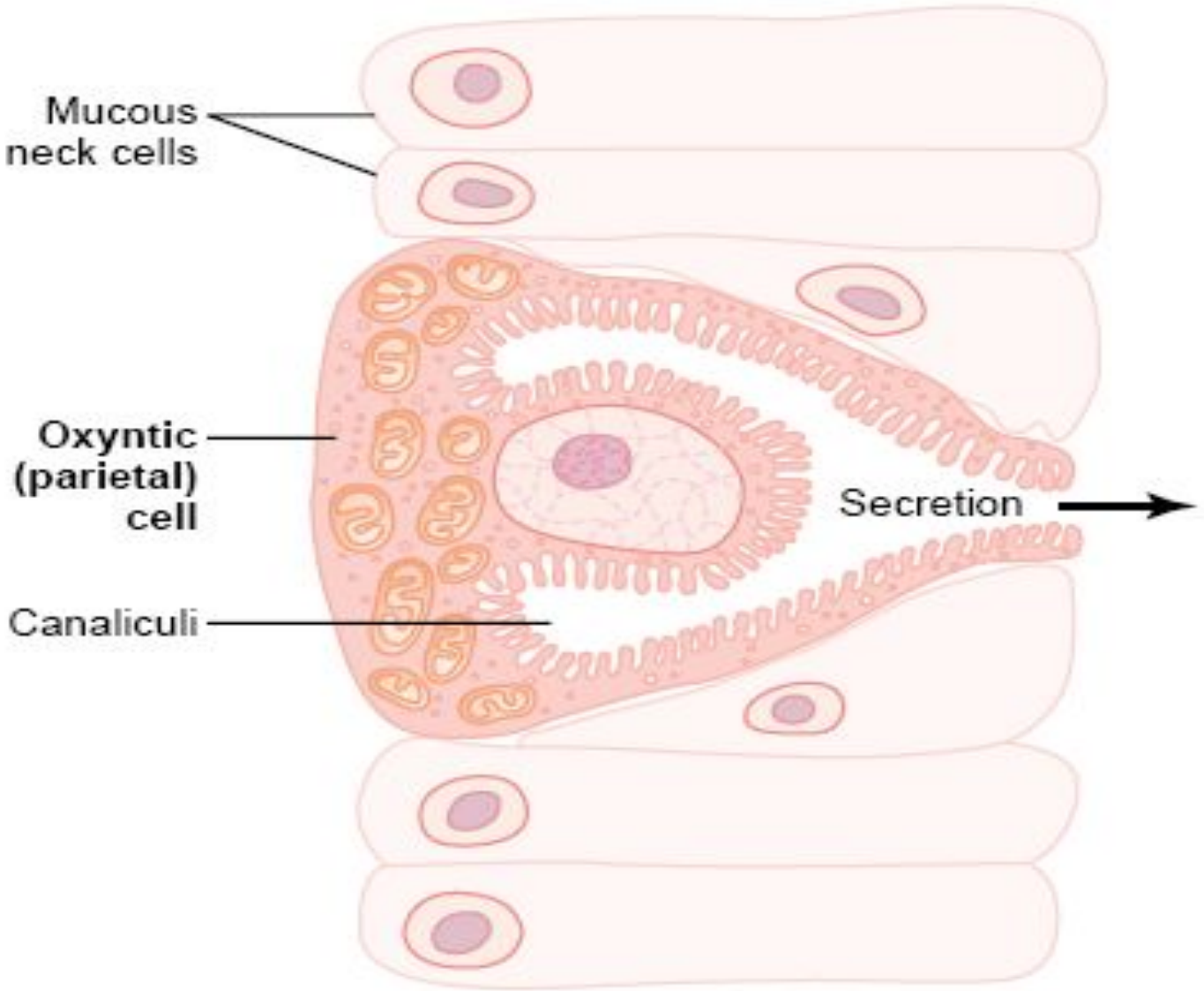
a.

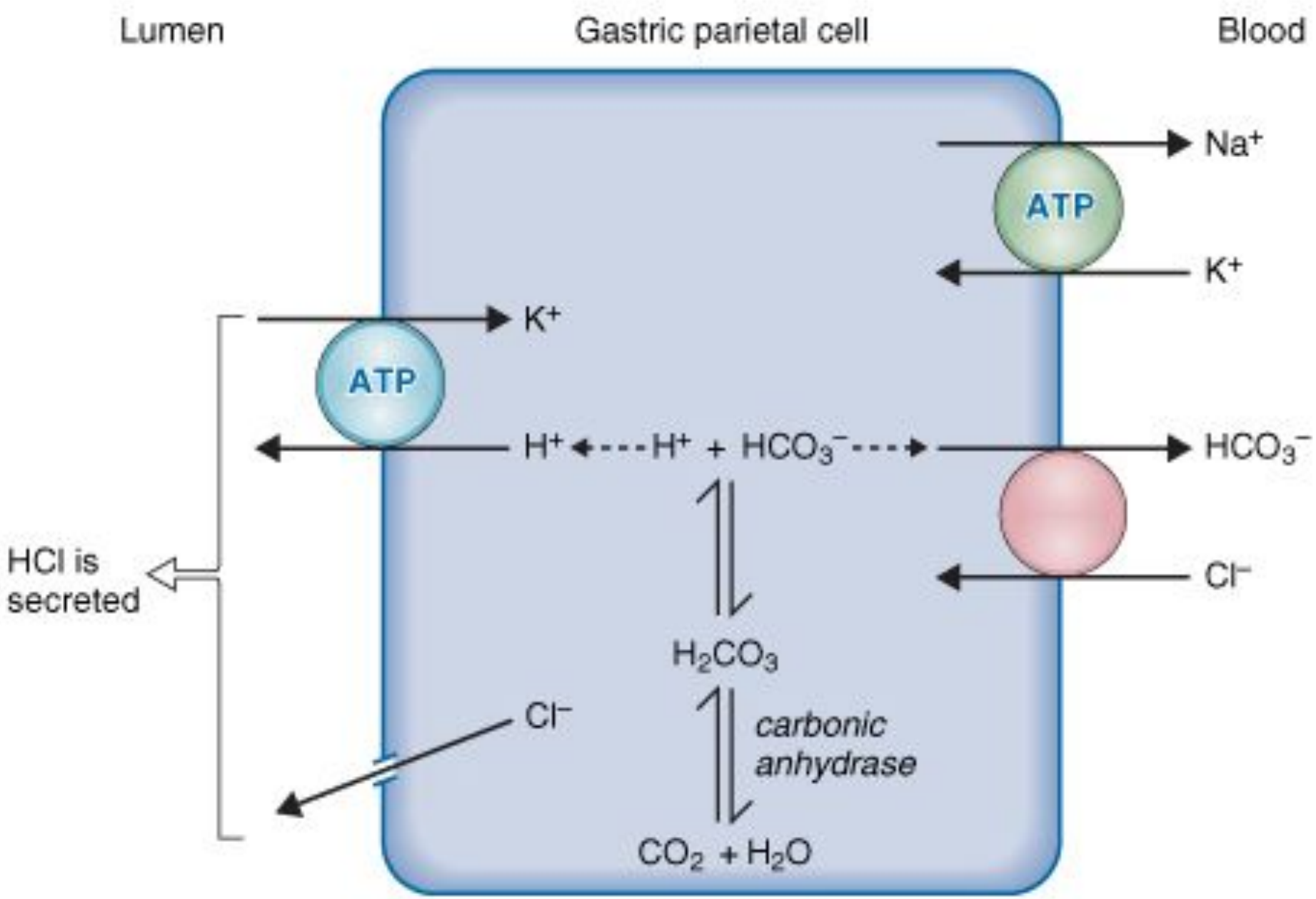

gastric pit
gastric pits
mucous cell
gastric gland
parietal cell
chief cell
mucosa
submucosa
b.
20 µm

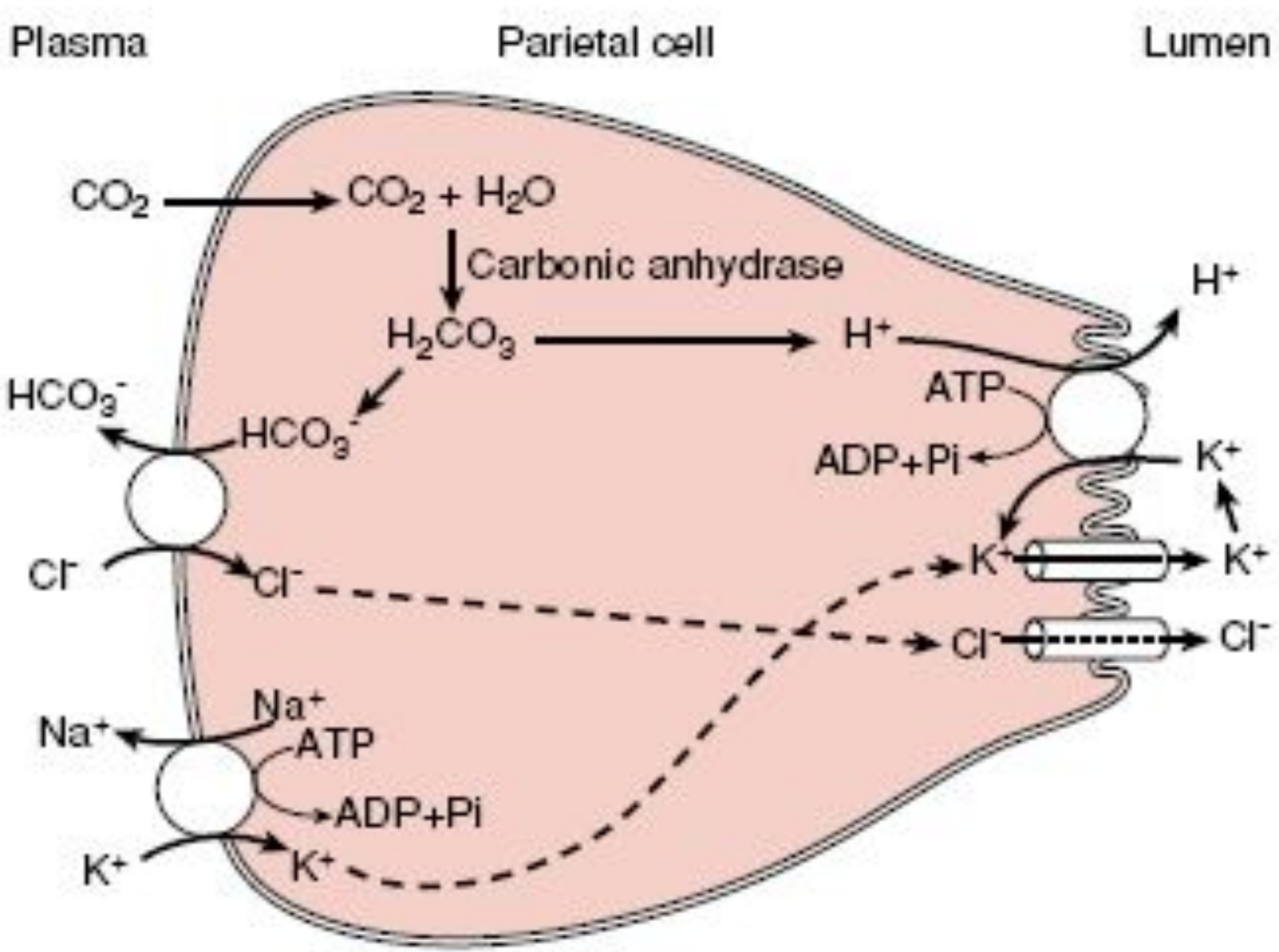
Visible & soluble mucus



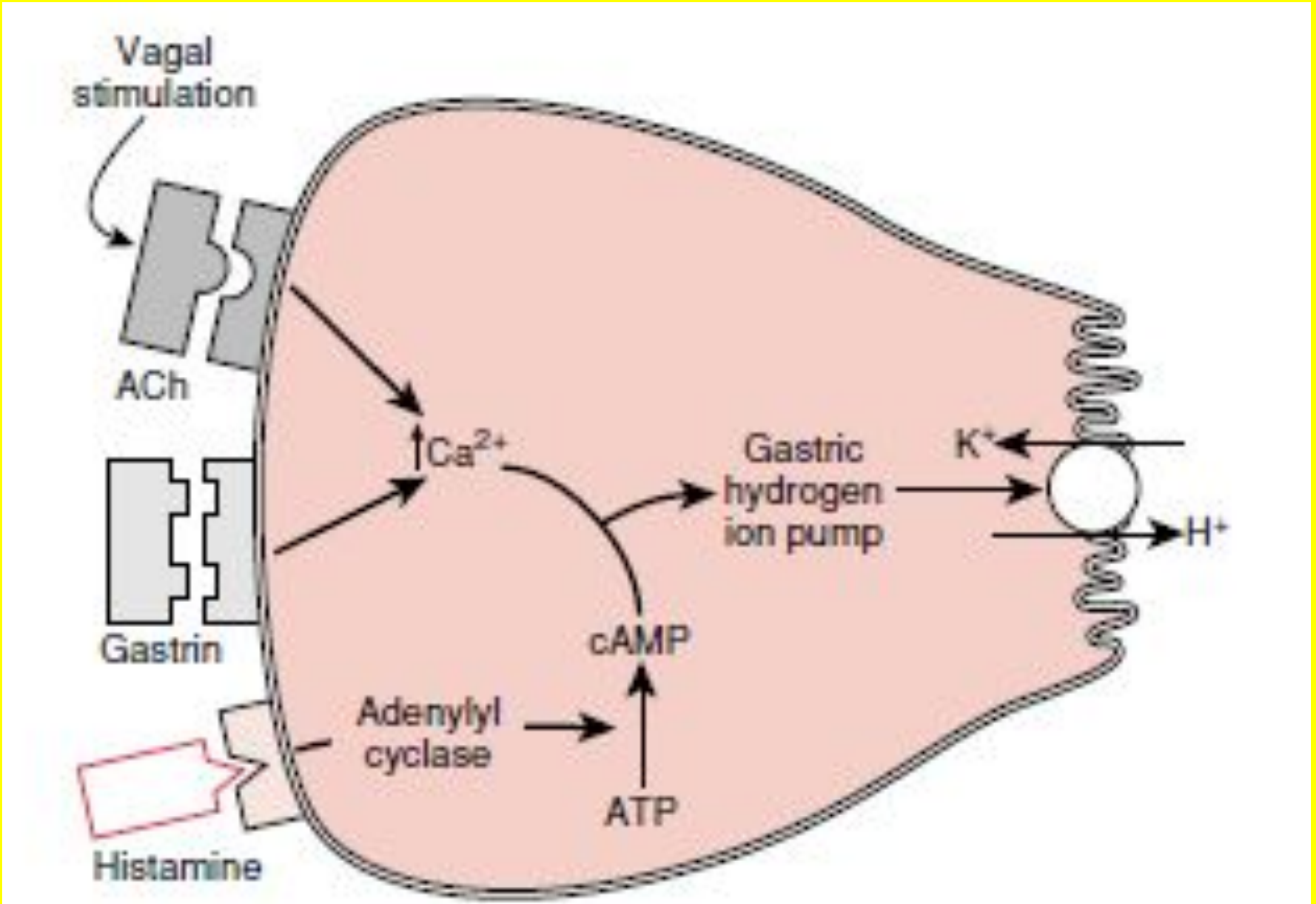
Mechanism of HCl secretion




Lumen
Gastric parietal cell
Blood
Na+
ATP
K+
K+
ATP
H+ H+ + HCO3−
HCO3−
HCl is secreted
Cl−
H2CO3
Cl−
carbonic anhydrase
CO2 + H2O


Plasma
Parietal cell
Lumen
CO_2
$CO_2 + H_2O$
Carbonic anhydrase
H_2CO_3
H^+
HCO_3^-
HCO_3^-
ATP
ADP+Pi
K^+
Cl^-
Cl^-
K^+
K^+
Cl^-
Cl^-
Na^+
Na^+
ATP
ADP+Pi
K^+
K^+

Control of HCl secretion



GASTRIN

secreted by G-cells in pyloric antrum.

secreted in blood- not into gastric juice

secreted as progastrin-inactive form

Appears to be neural in origin– APUD cells.(neuro-endocrine cell)

APUD cells - cells responsible for amine precursor uptake and decarboxylation

Occurs in three forms- G34, G17, G14

G-17 principle form , inactivated in kidney and small intestine.

Pentagastrin-synthetic gastrin

Gastrinoma- occur in stomach, duodenum, pancreatic tumour of delta cells. Secrete large amount of gastrin- predispose to peptic ulcer.

Functions of gastrin:

Main function is to stimulate HCl & pepsinogen secretion. Gastrin aslo acts by stimulating secretion of histamine by ECL(enterchromaffin like) cells

other functions:-

Increase gastric and intestinal motility.

Increase pancreatic secretion of insulin and glucagon.

Trophic action-necessary for the proper growth of GI mucosa

Phases of gastric juice secretion

- **Interdigestive:-**
- **Usually mucus, very less pepsin & nill acid**
- **If emotional stimuli then acid & pepsin increase which is the cause of peptic ulcer**
- **Digestive**
- **Cephalic phase- 20%- vagally mediated. induced by activity in CNS .**
- **Gastric phase:-local reflex & in response to gastrin**
- **Intestinal phase:- reflex & hormonal**

Cephalic phase

- 2 types of reflexes- conditioned reflex
  - unconditioned reflex

Appetite juice :-

- rich in pepsin, acidic in reaction & contain mucus.

-composition of juice are constant and does not vary with type of food.

-The quantity varies with intensity of appetite.

-Secretion is inhibited by- shock, fear, anxiety.

Imp-help initiate next phase of gastric secretn.

Gastric phase: 70%

- **Neural mechanism-**

a) Long vagovagal reflexes- distension of stomach

- tactile stimuli

- amino acids/ peptides, HCL

b) Short enteric reflexes.

- **Humoral mechanism: gastrin**

When pH is very less then feedback inhibition for protection

Intestinal phase

- Gastrin like hormone- initially increase secretion.

Inhibition of gastric secretion by intestinal factors:

- Hormones:

GIP

Entrogastrin

Secretin.

- Reflexes:

Entrogasric reflex-reduce motility ,reduce gastric secretion

Functional imp – to slow release of contents of stomach when the small intestine is already filled.

Methods of collection of pure gastric juice

- **Interdigestive phase-** secretion is very low
- **After meal-** secretion increases but cannot be collected without contamination of food.
- In animals two very important experiments have been done-

1. the experiment of sham feeding.
2. the preparation of pouches,

Sham feeding

- Esophagus is exposed
- Cut into two parts and brought to surface.
- Food is given and gastric secretion is collected.
- Imp- food can stimulate gastric secretion even before entering the stomach.(unconditioned reflex)
- Vagotomy - secretion is absent

  - vagus is important for cephalic phase

Pavlov's esophagostomy and sham-feeding experiments

pouches

Uses:

- **To obtain pure sample of gastric juice**
- **to study the different phases of gastric secretion.**
- **To study the conditioned reflex.**

1.Pavlov’s pouch

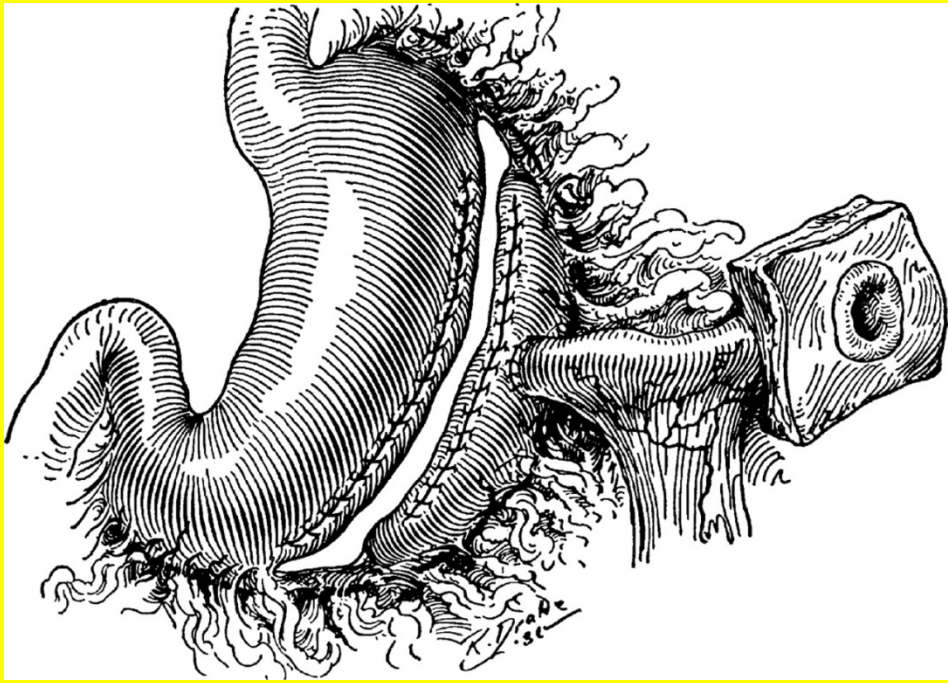
2. Heidenhaim’s pouch

3. Bickel’s pouch

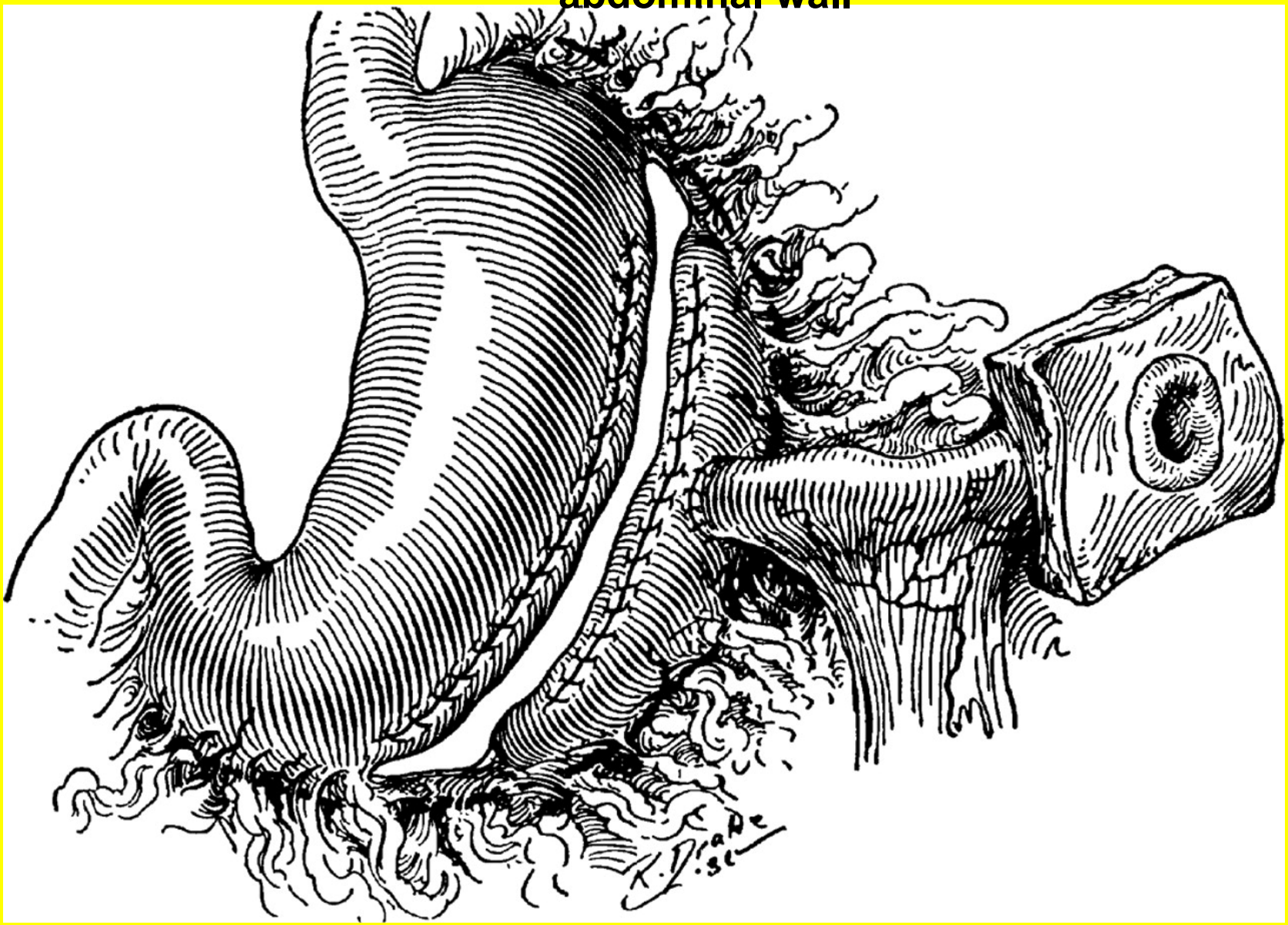
4.Farrel and ivy pouch

Pavlov's pouch

- Small diverticulum, represent 1/8 portion of stomach.
- Nerve supply and blood supply kept intact.
- Gastric juice is collected with different stimuli and can be analyzed.
- Role of vagus

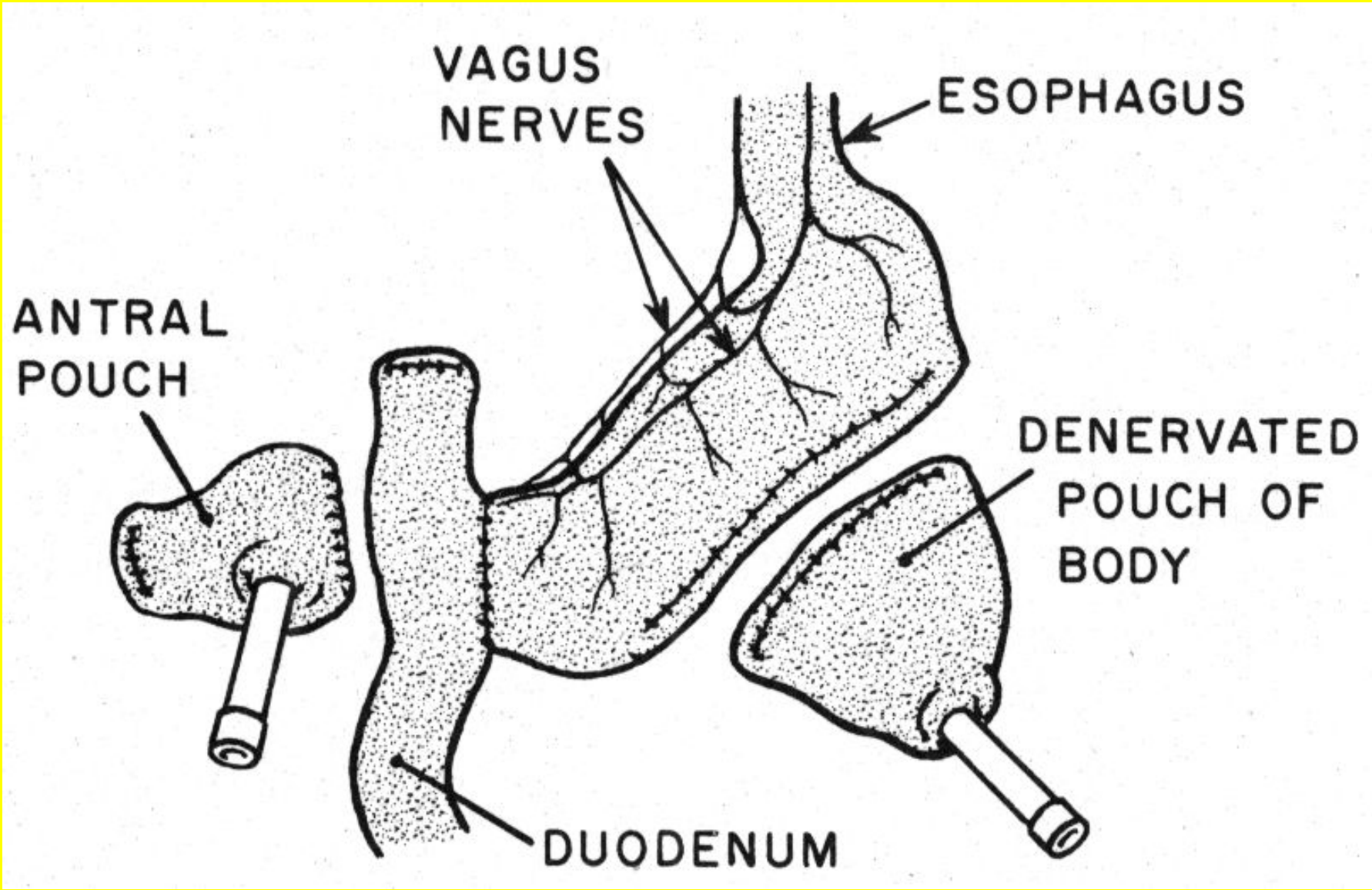


A Pavlov gastric pouch The pouch is surgically prepared with a fistula formed by a segment of small intestine with stoma at the surface of the abdominal wall



Heidenhaims pouch

- Sympathetic and blood supply is kept
- Use: useful to demonstrate the role of sympathetic nerve and also to demonstrate the hormonal regulation of gastric secretion after Vagotomy.
- Distension by balloon
- Iv injection of pure gastrin


VAGUS
NERVES
ESOPHAGUS
ANTRAL
POUCH
DENERVATED
POUCH OF
BODY
DUODENUM

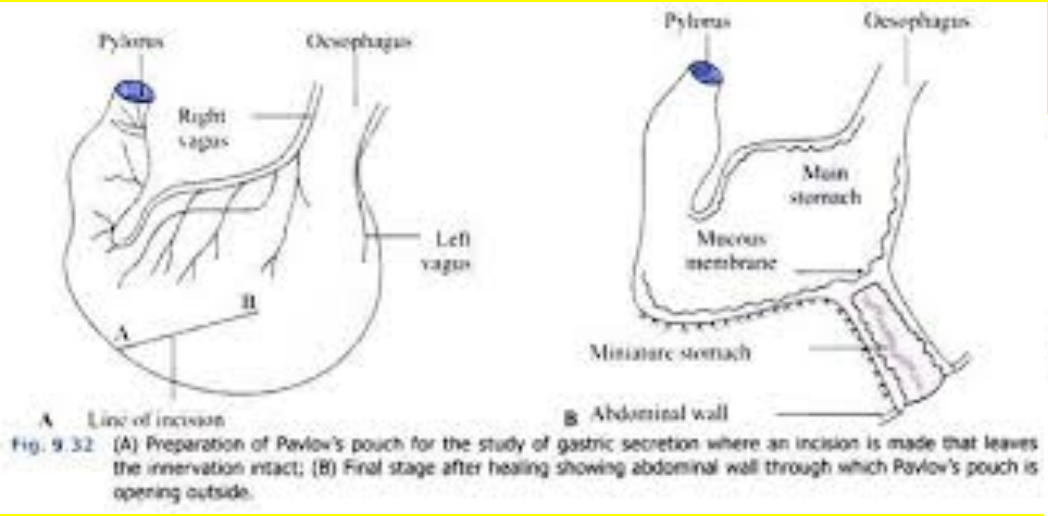
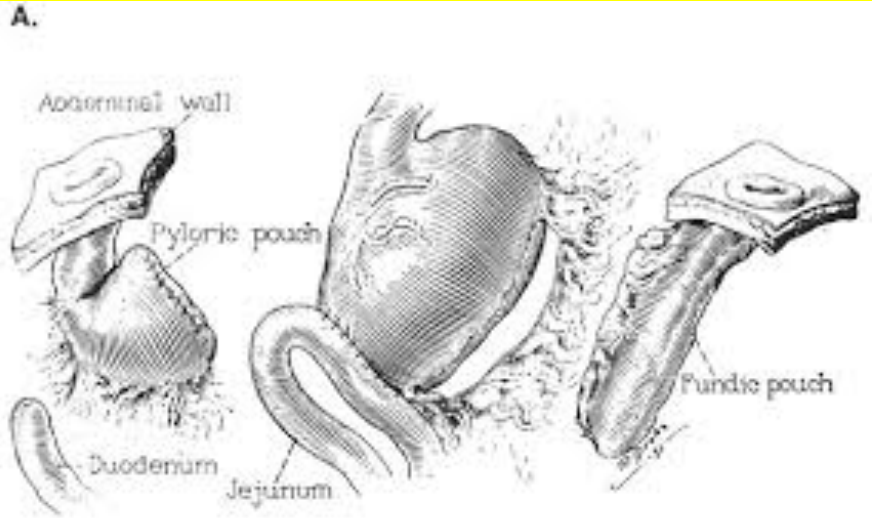
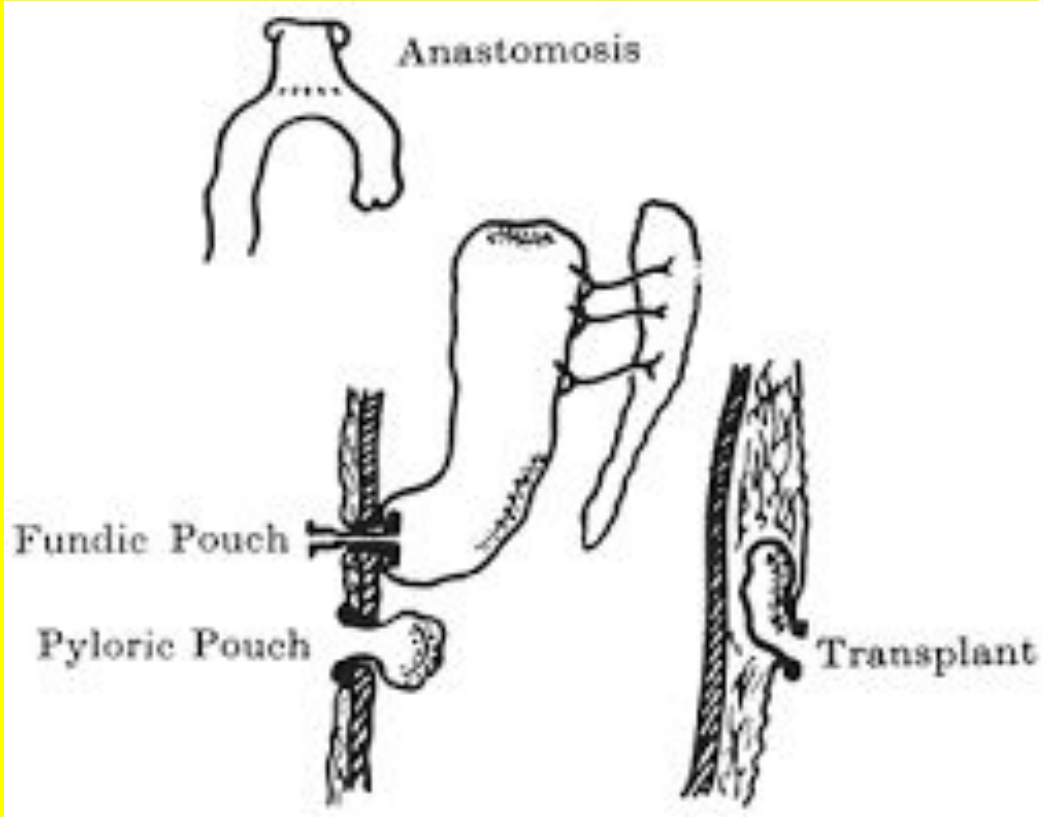
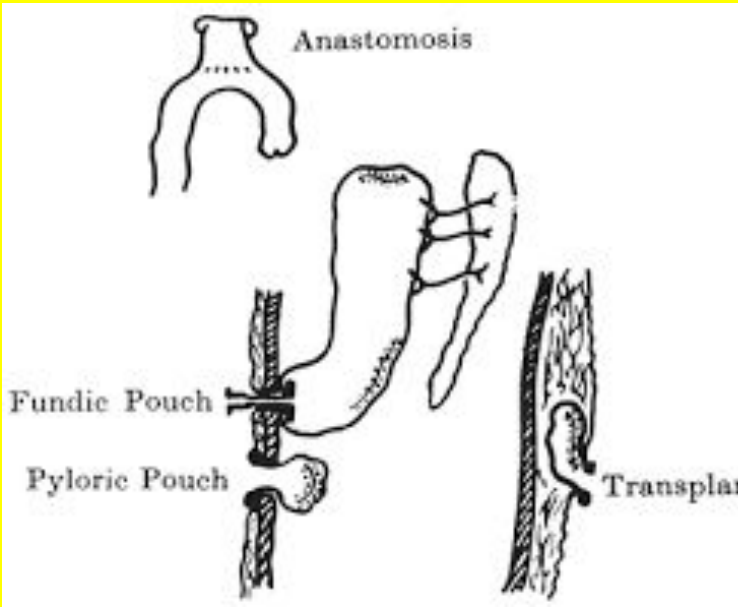


Fig. 9.32 (A) Preparation of Pavlov's pouch for the study of gastric secretion where an incision is made that leaves the innervation intact; (B) Final stage after healing showing abdominal wall through which Pavlov's pouch is opening outside.







Bickel’s pouch

- Sympathetic nerve is also cut .
- Totally denervated pouch.
- Demonstrate role of gastrin in gastric secretion.

Farrel and ivy pouch

- Completely removed and implanted in subcutaneous tissue of same animal. Blood vessels develops after some time and this pouch then used for study.

- Use: to study role of hormones during gastric and intestinal phases of gastric secretion & interdigestive secretion

Gastric function tests

are done primarily to investigate gastric acid secretion.

1. fractional test meal
2. histamine test
3. augmented histamine test
4. pentagastrin test-to know the maximum acid output.
5. insulin test
6. barium meal study
7. Intrinsic factor measurement
8. endoscopic examination and biopsy

Applied

- Gastritis (acute & chronic)
- Gastric ulcer(acid peptic digestion)/peptic ulcer
- Gastric atrophy & Pernicious anemia
- GERD(gasro-espophageal reflux disease)
- Polyp
- Zollinger ellison syndrome-gastrinoma in duodenum or pancreas
- Gastric cancer

THANK YOU