Pathology of the stomach

Dr. Omar Hamdan

Gastrointestinal and liver pathologist
Mutah University
School of Medicine-Pathology Department
Undergraduate Lectures 2023

Overview

- Gastric diseases:

  1-Inflammatory.

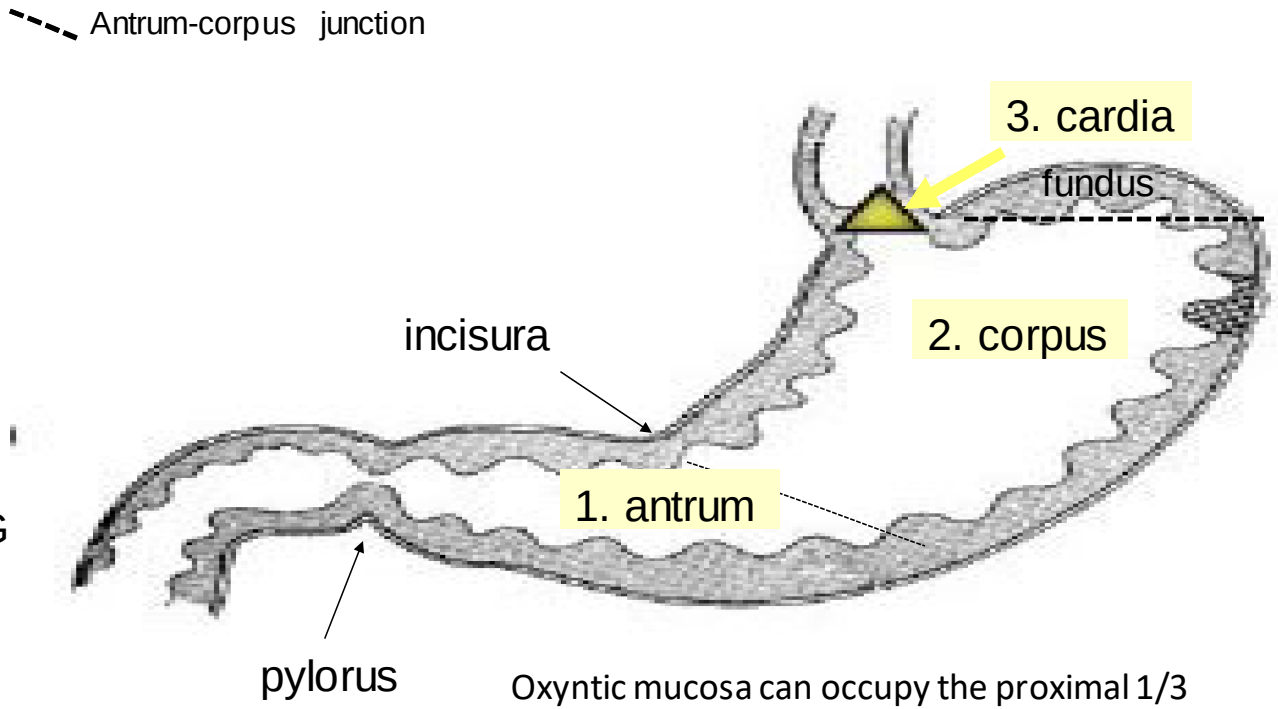
  2-Neoplastic.

- Stomach parts: cardia, fundus, body, antrum, pylorus.

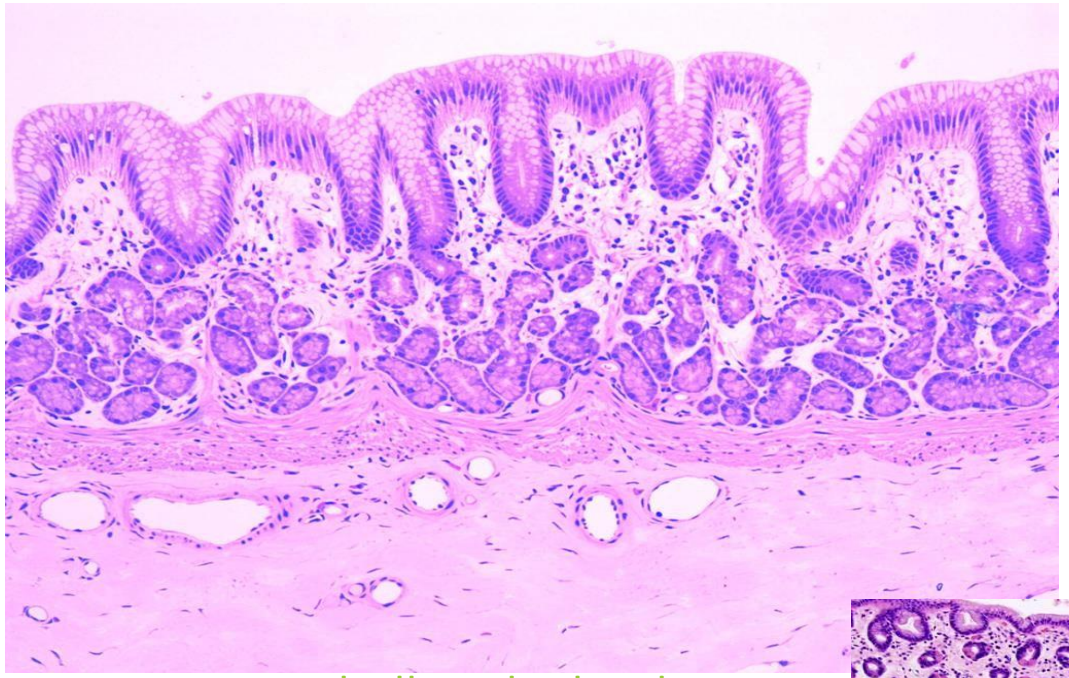
Normal Stomach

3 Regions

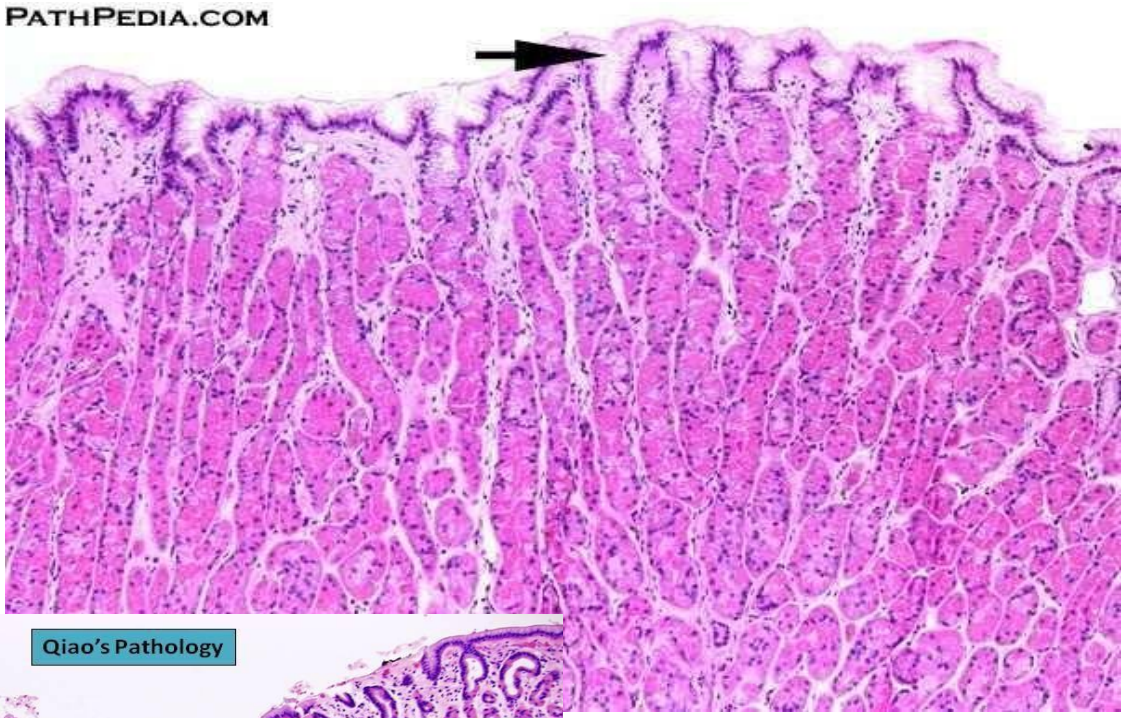
- Cardia: mucin secreting foveolar cells.
- Body and fundus: parietal cells (HCL) and chief cells (pepsin).
- Antrum: neuroendocrine G cells (gastrin)

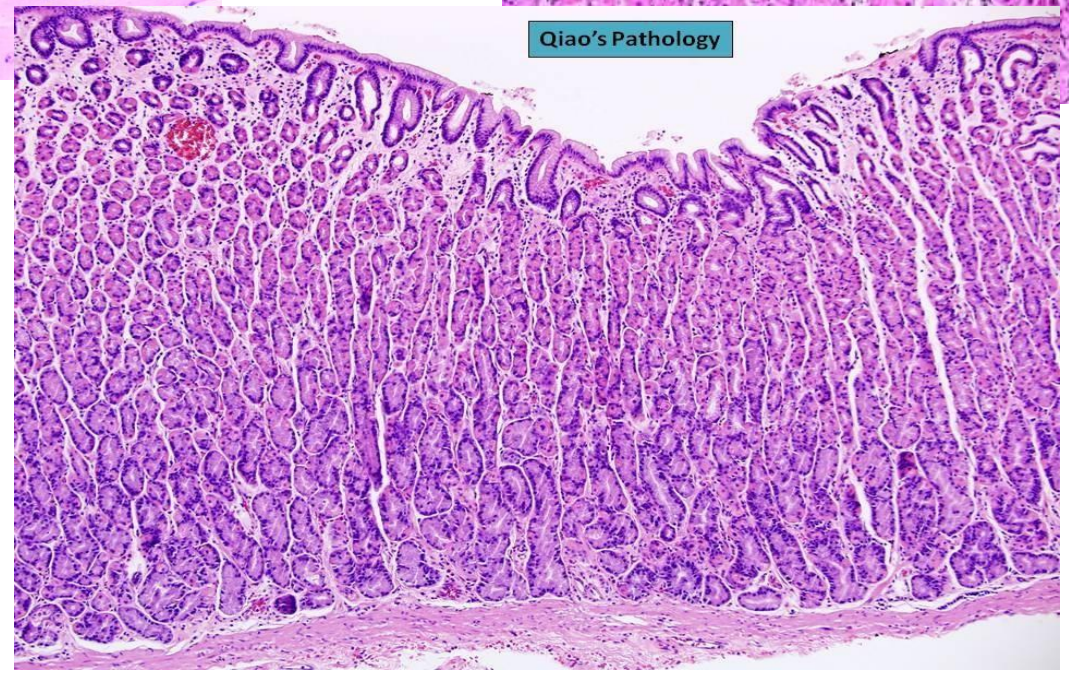


Oxyntic mucosa can occupy the proximal 1/3 of the antrum

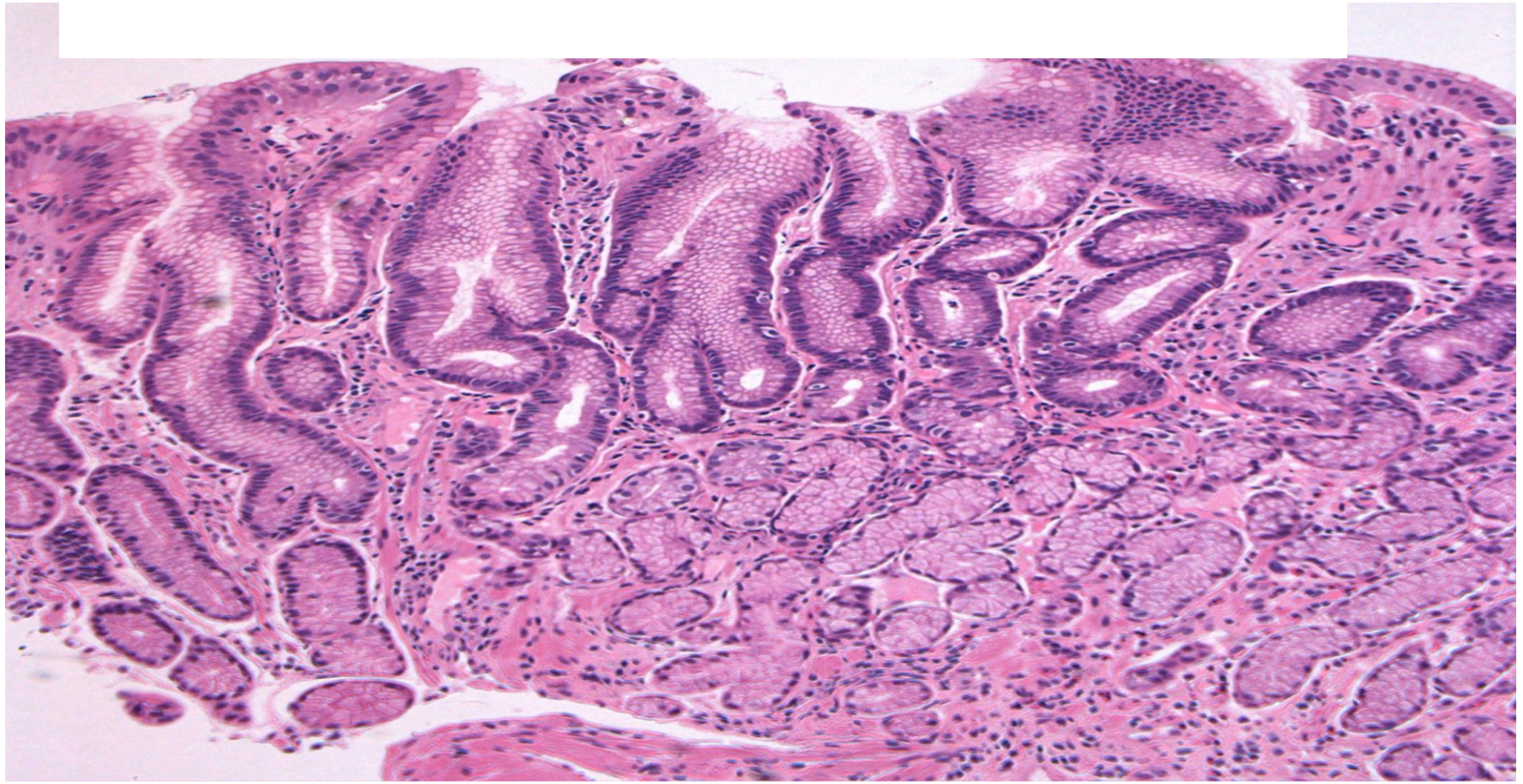


medcell.med.yale.edu

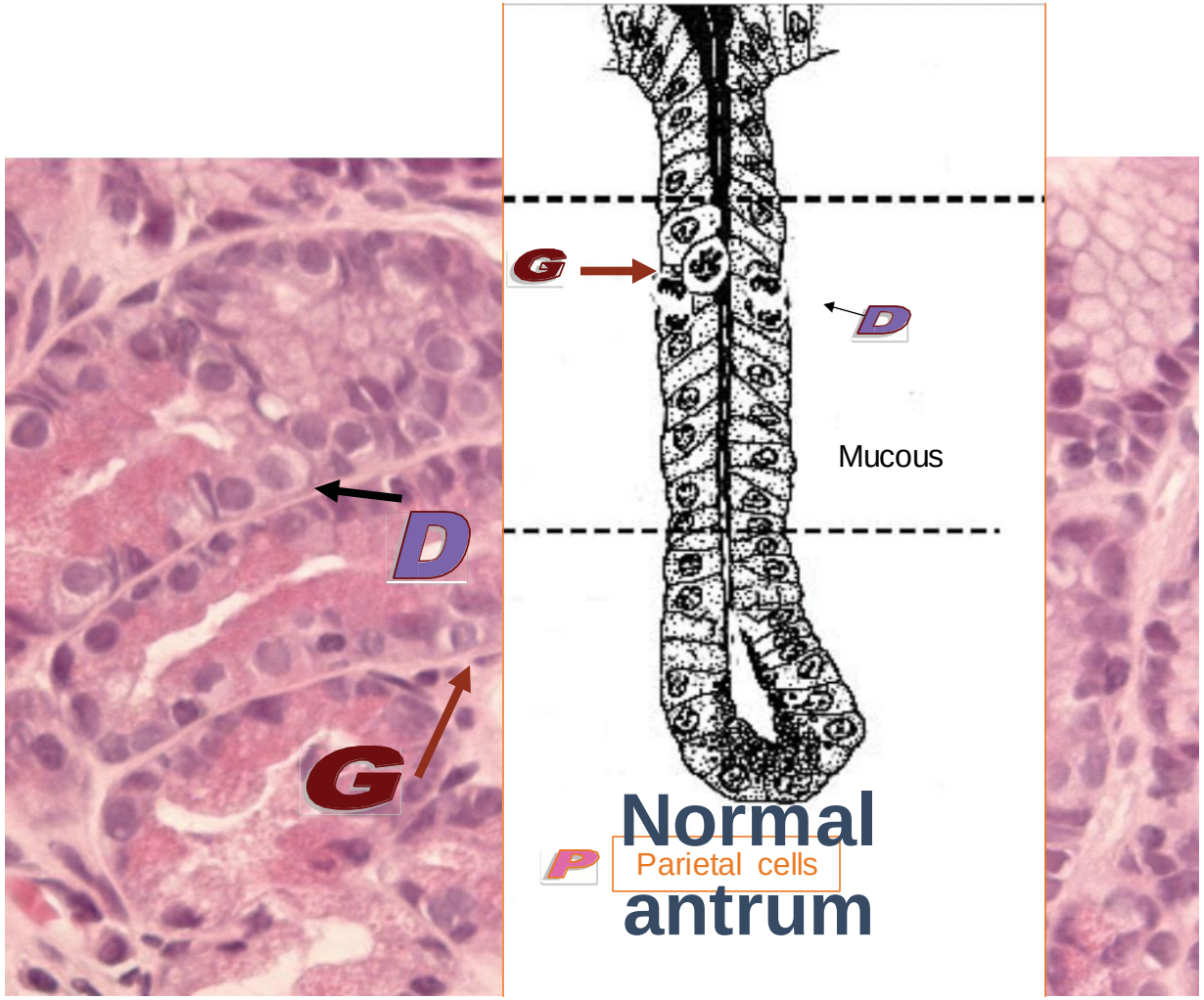




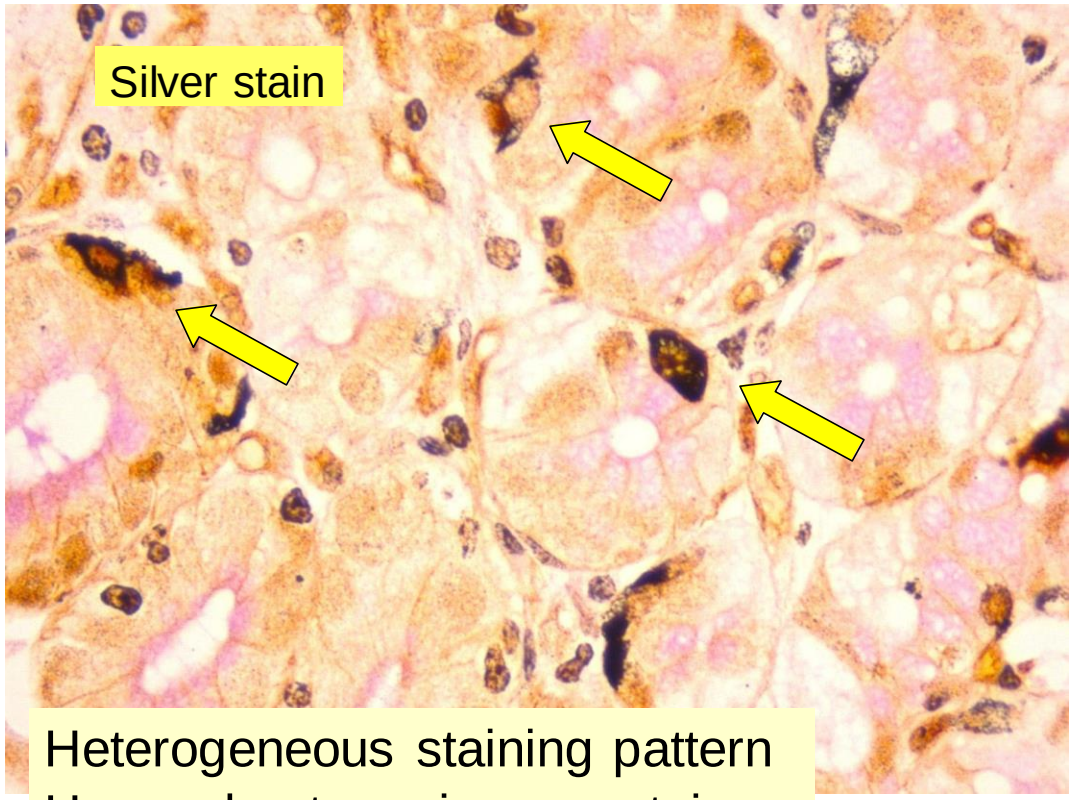
Antrum



Antrum

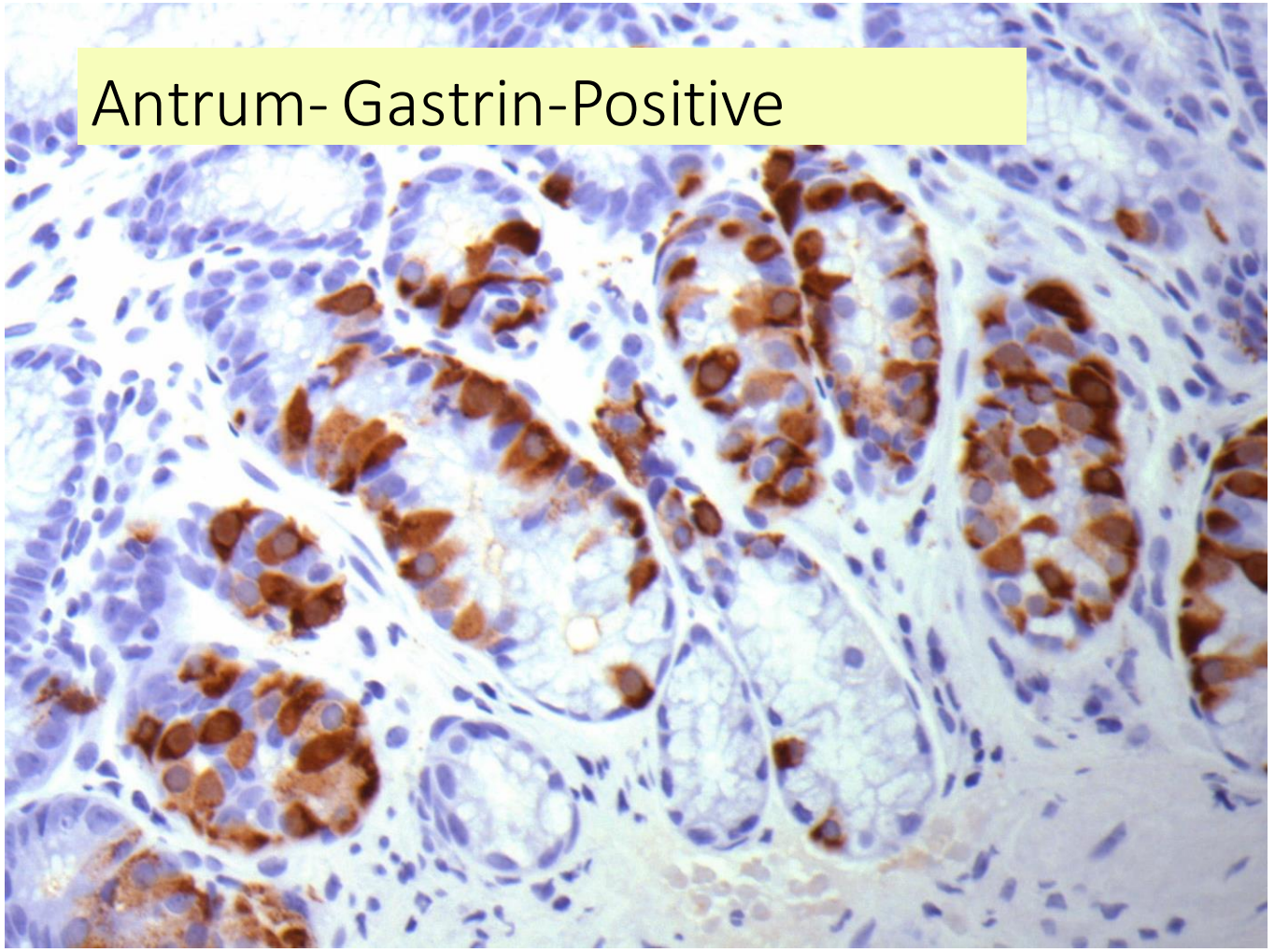


Antrum endocrine cells



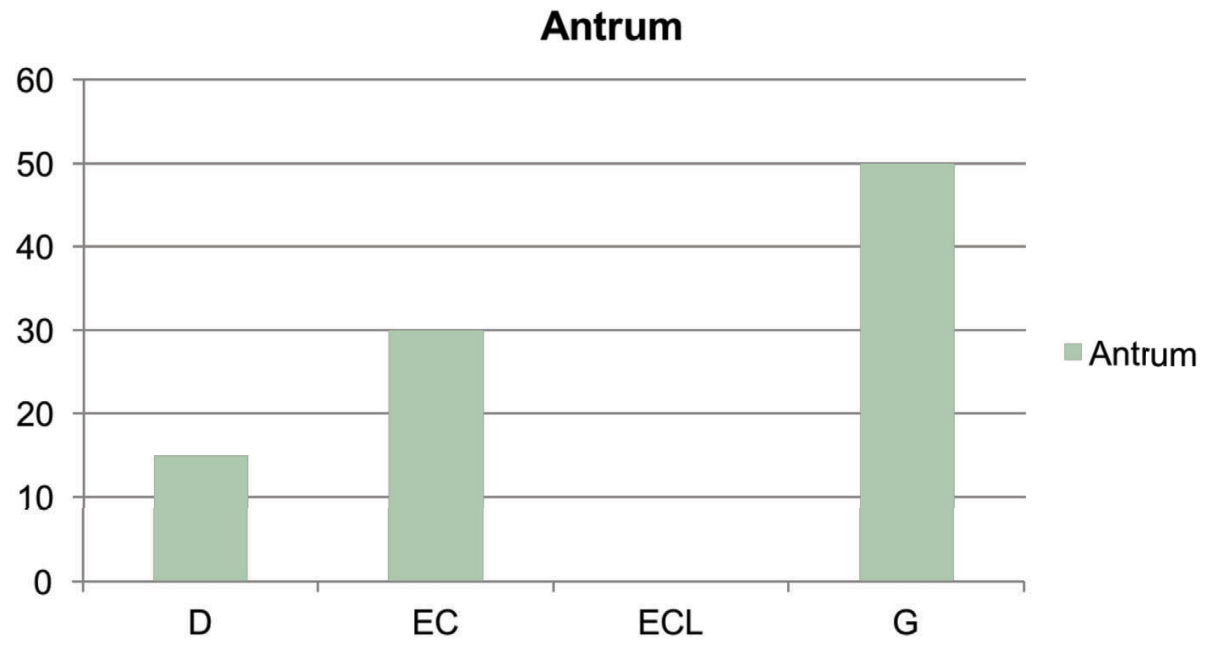
Heterogeneous staining pattern
Hence: best use immunostains

Antrum- Gastrin-Positive

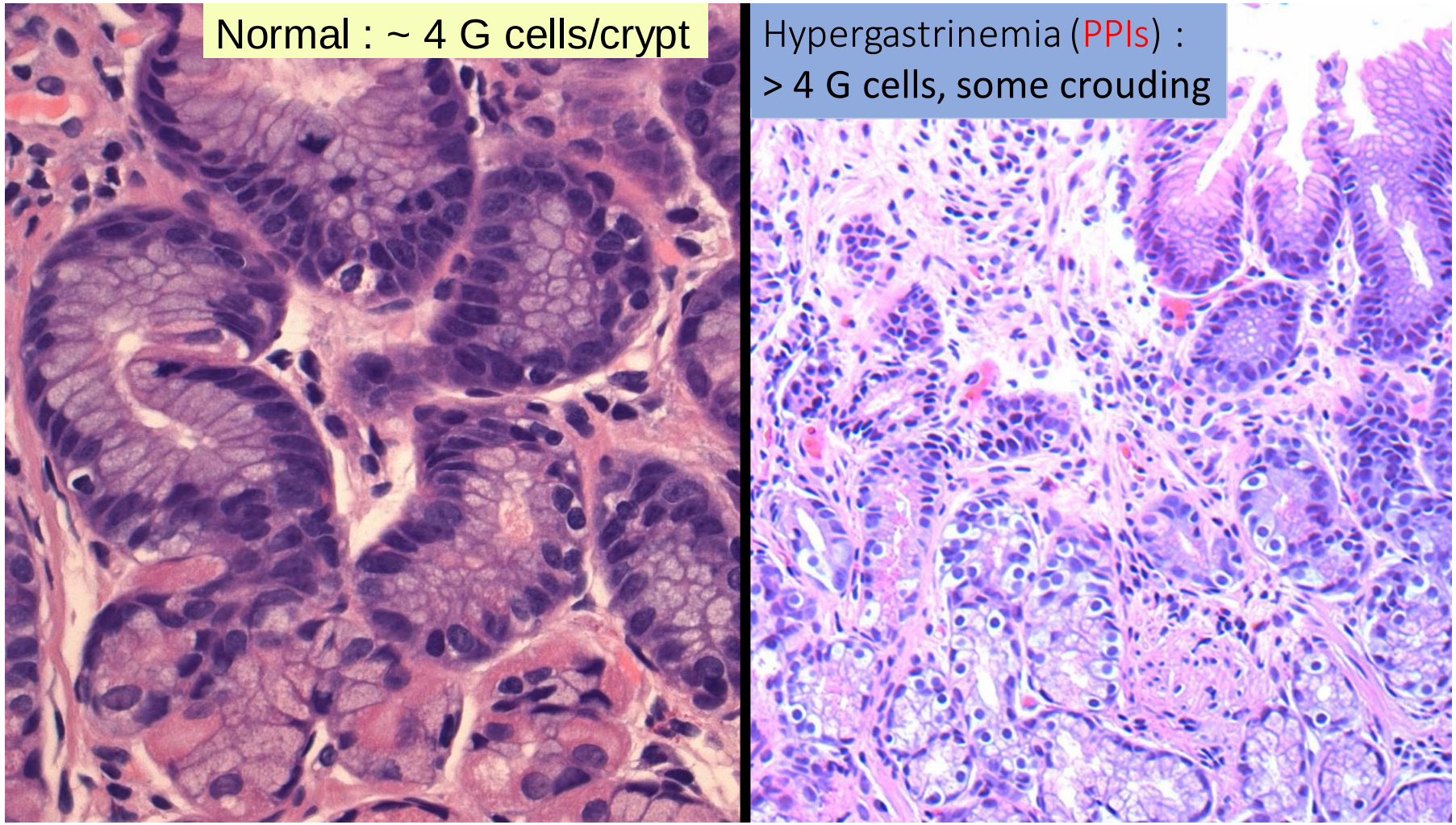


Endocrine Cells Antrum

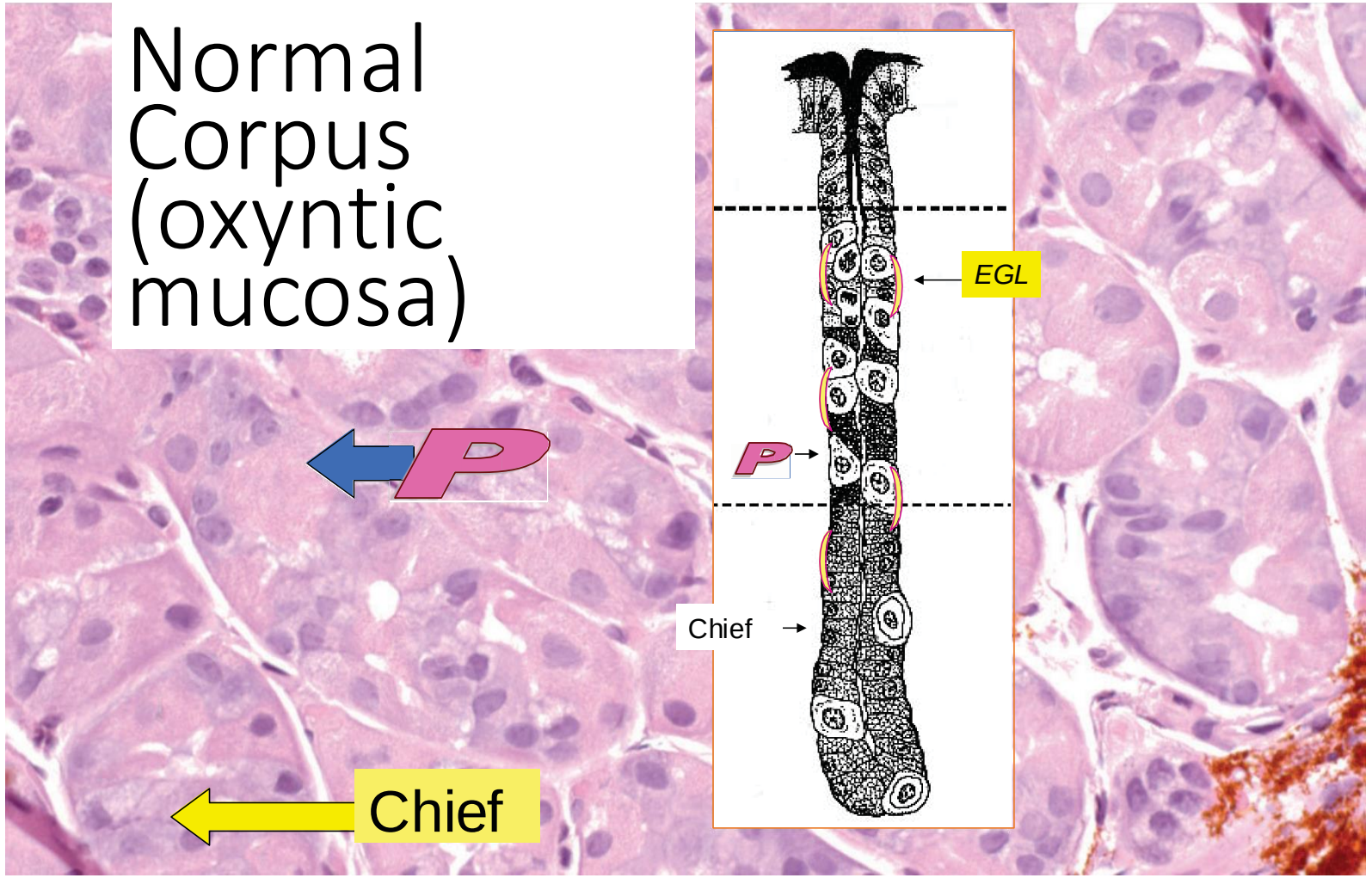
D somatostatin, EC serotonin, ECL histamine or Ghrelin, G gastrin



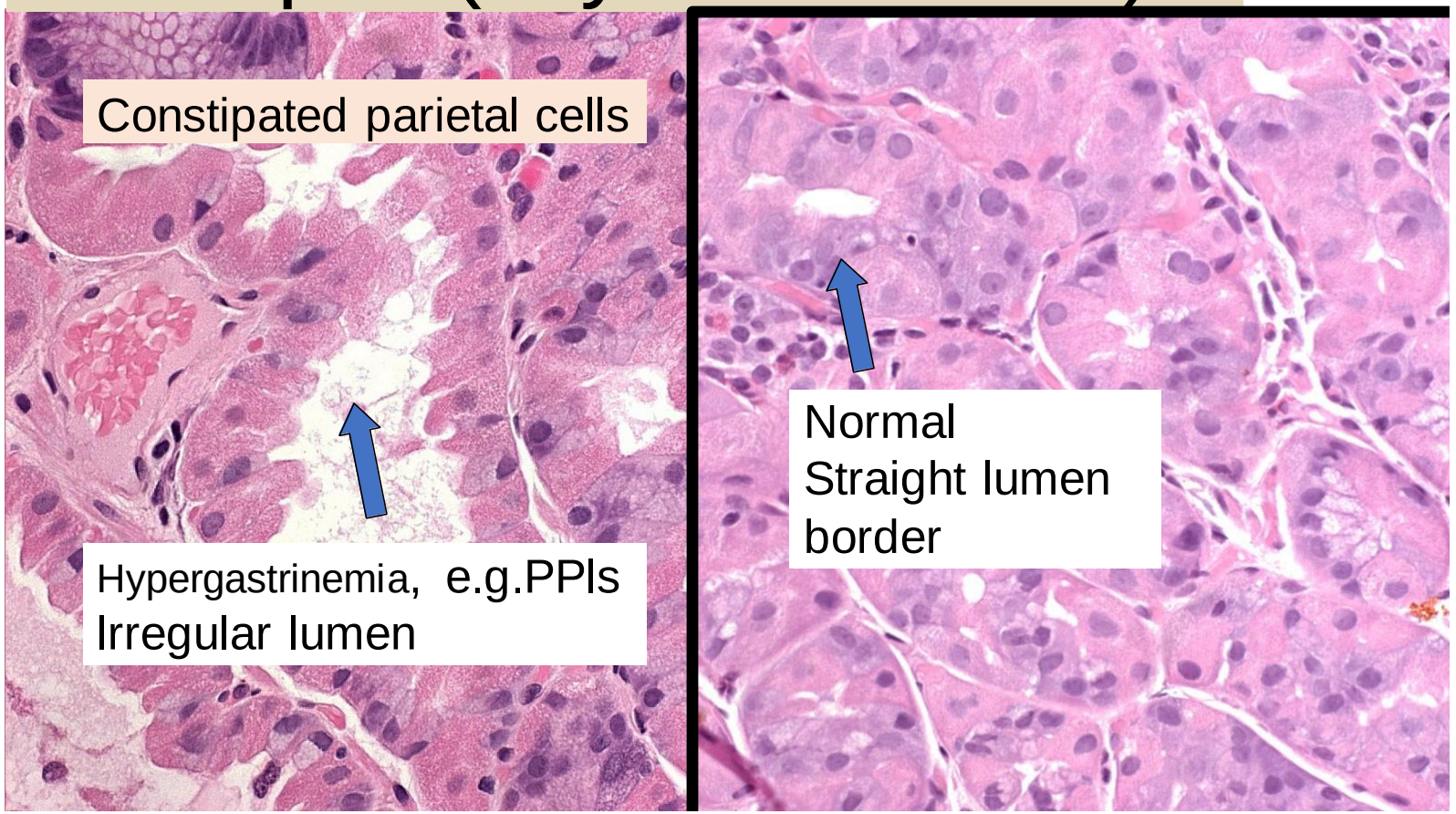
Modified from Gasteroenterologia Polska 2006, 13(1): 7-10


Normal : ~ 4 G cells/crypt
Hypergastrinemia (PPIs) :
> 4 G cells, some crouding

Normal Corpus (oxyntic mucosa)

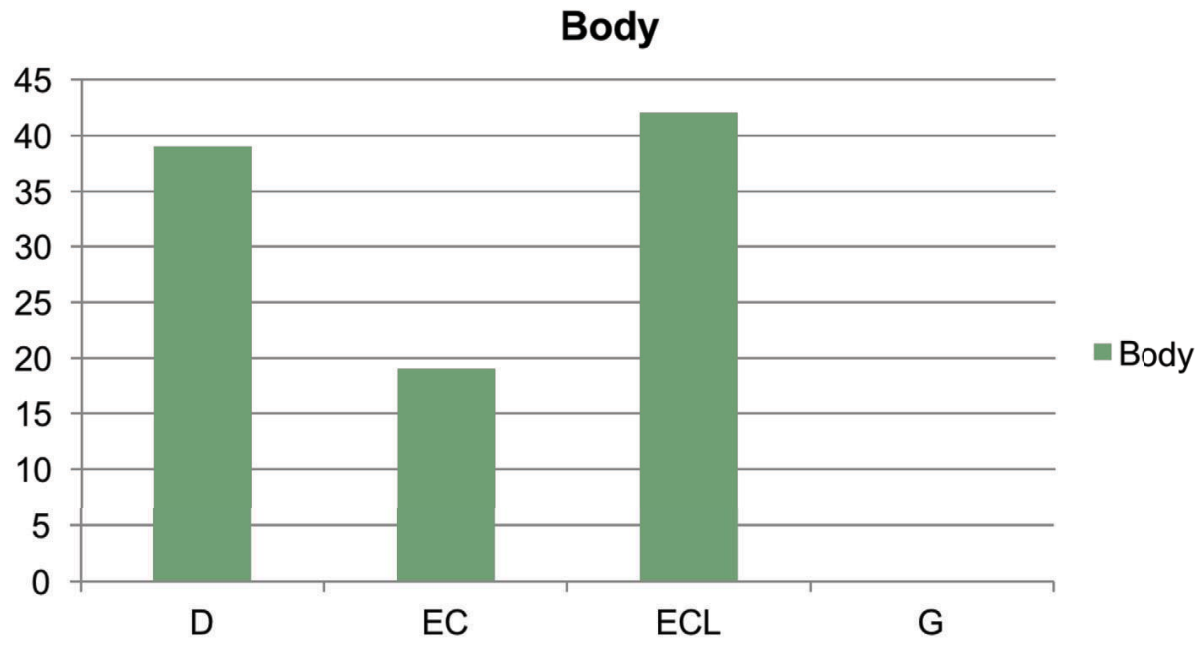


Corpus (oxyntic mucosa)



Endocrine Cells body

D somatostatin, EC serotonin, ECL histamine or Ghrelin, G gastrin

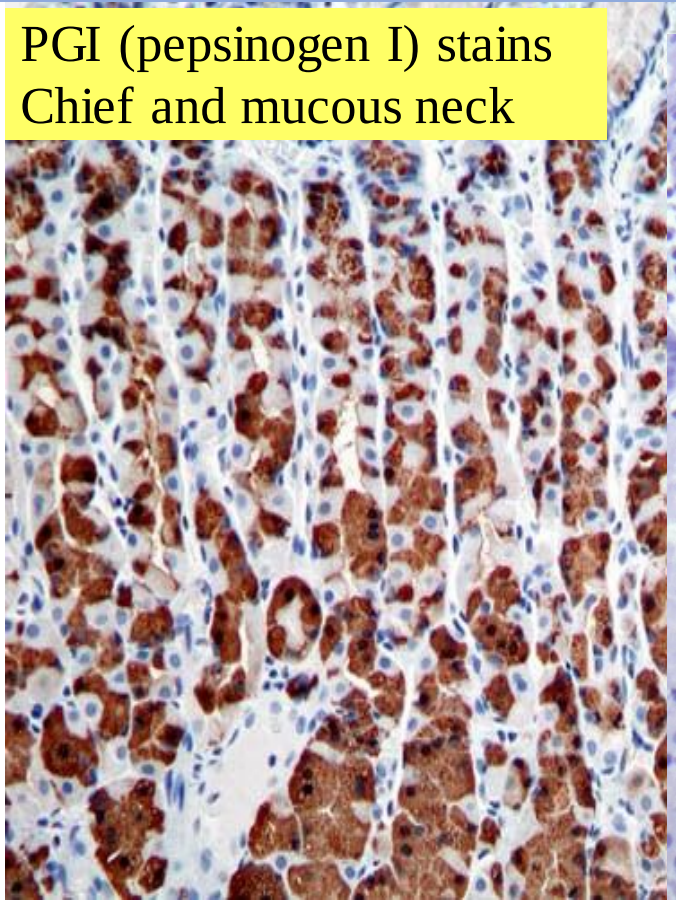


Modified from Gasteroenterologia Polska 2006, 13(1): 7-10

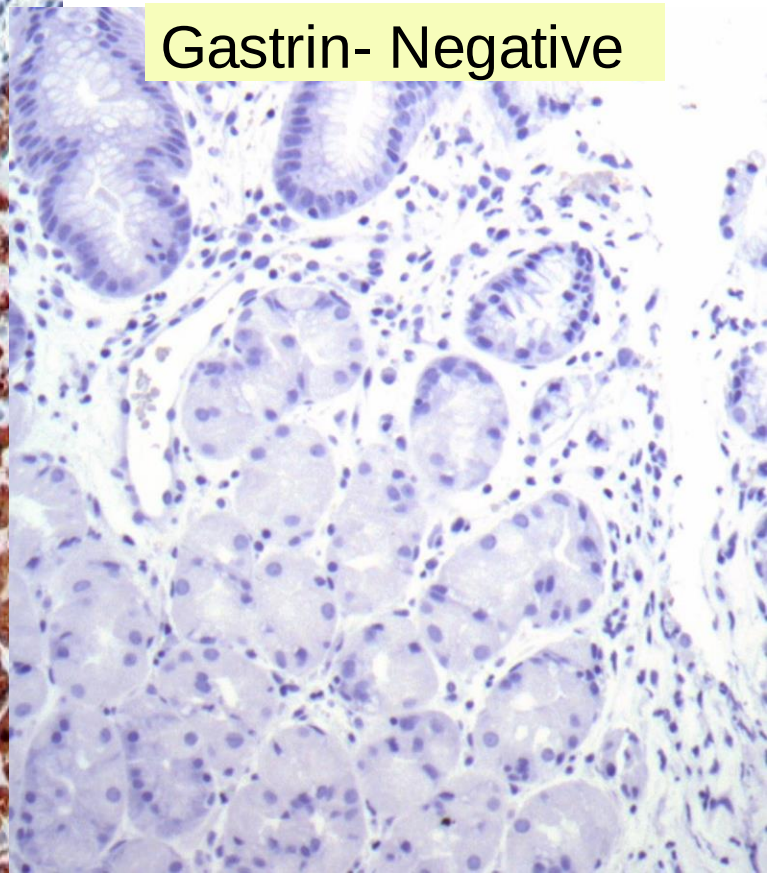
NORMAL CORPUS

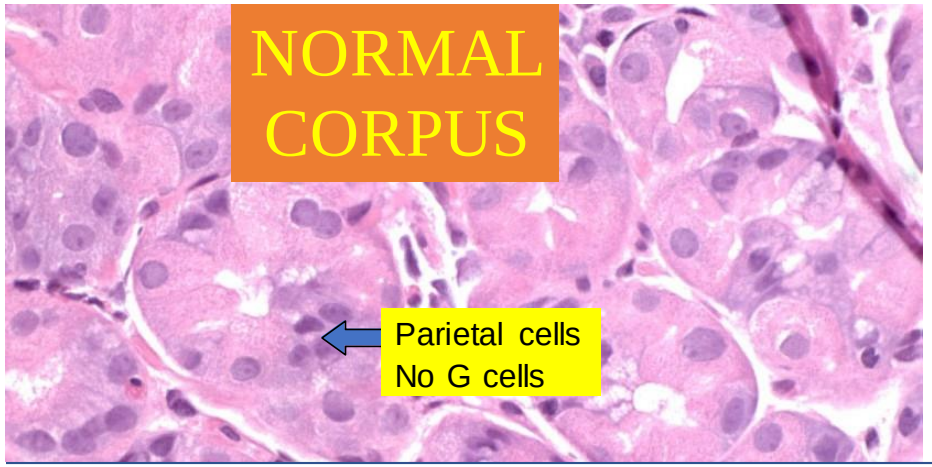
Oxyntic endocrine cells make histamine or ghrelin, not gastrin

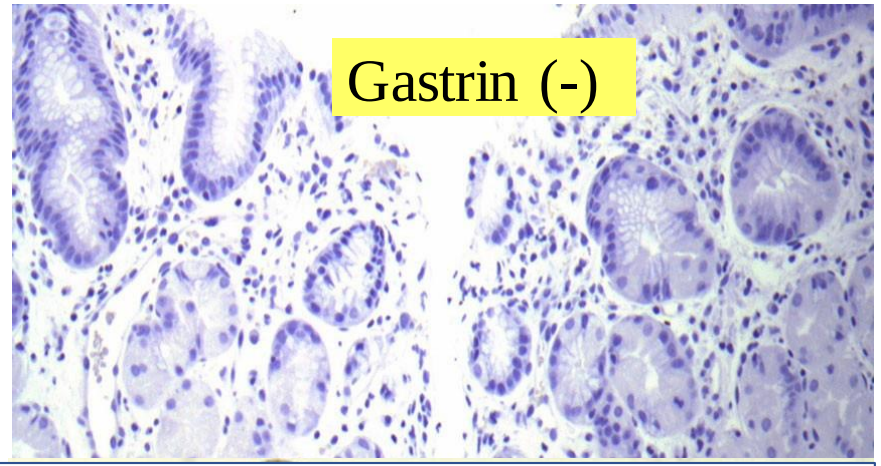
PGI (pepsinogen I) stains Chief and mucous neck

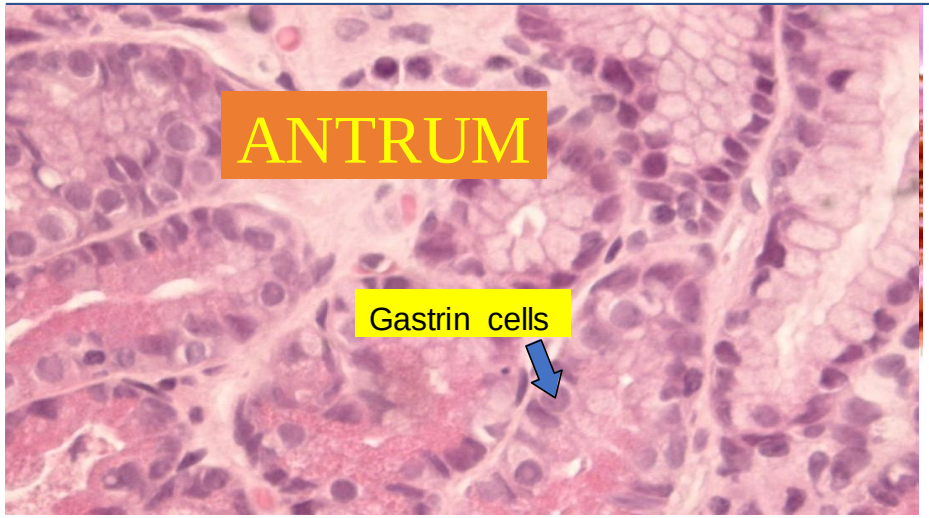


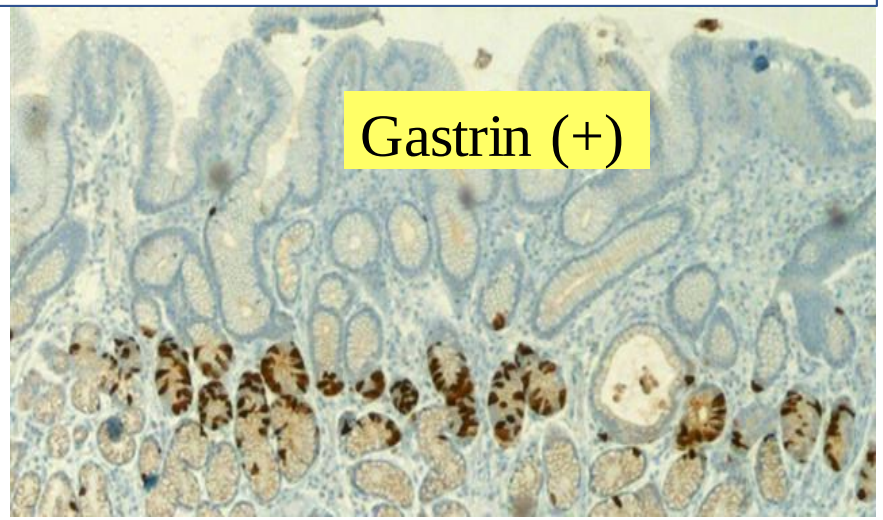
Gastrin- Negative




NORMAL
CORPUS
Parietal cells
No G cells

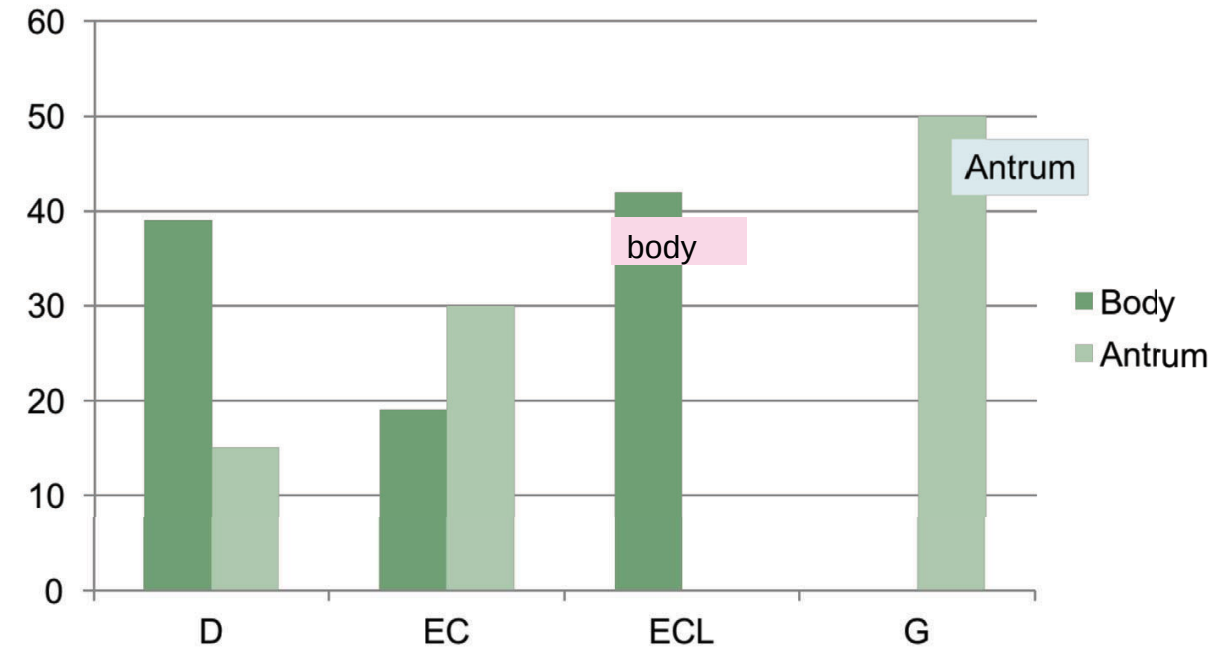

Gastrin (-)


ANTRUM
Gastrin cells


Gastrin (+)

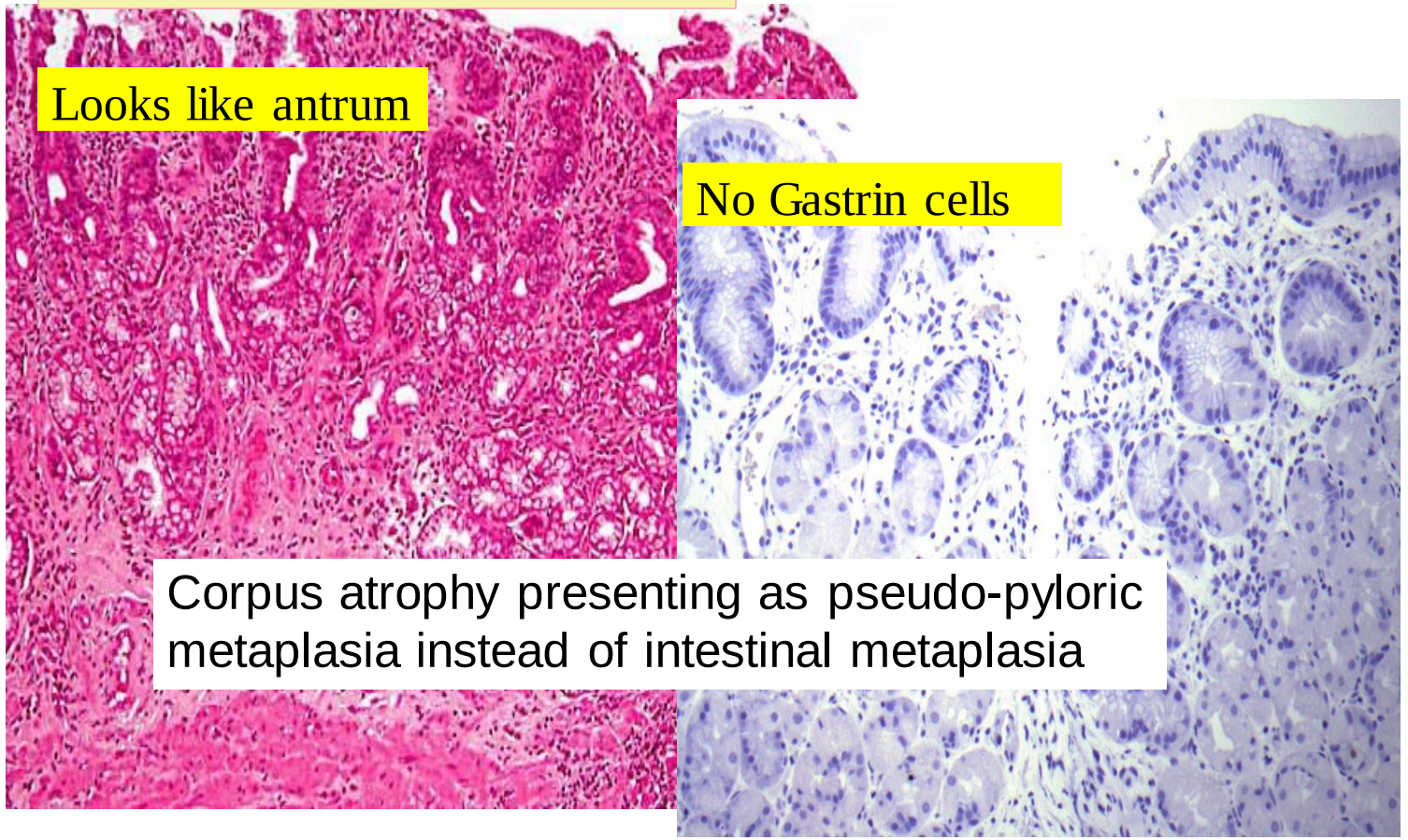
Endocrine Cells Stomach

D somatostatin, EC serotonin, ECL histamine or Ghrelin, G gastrin



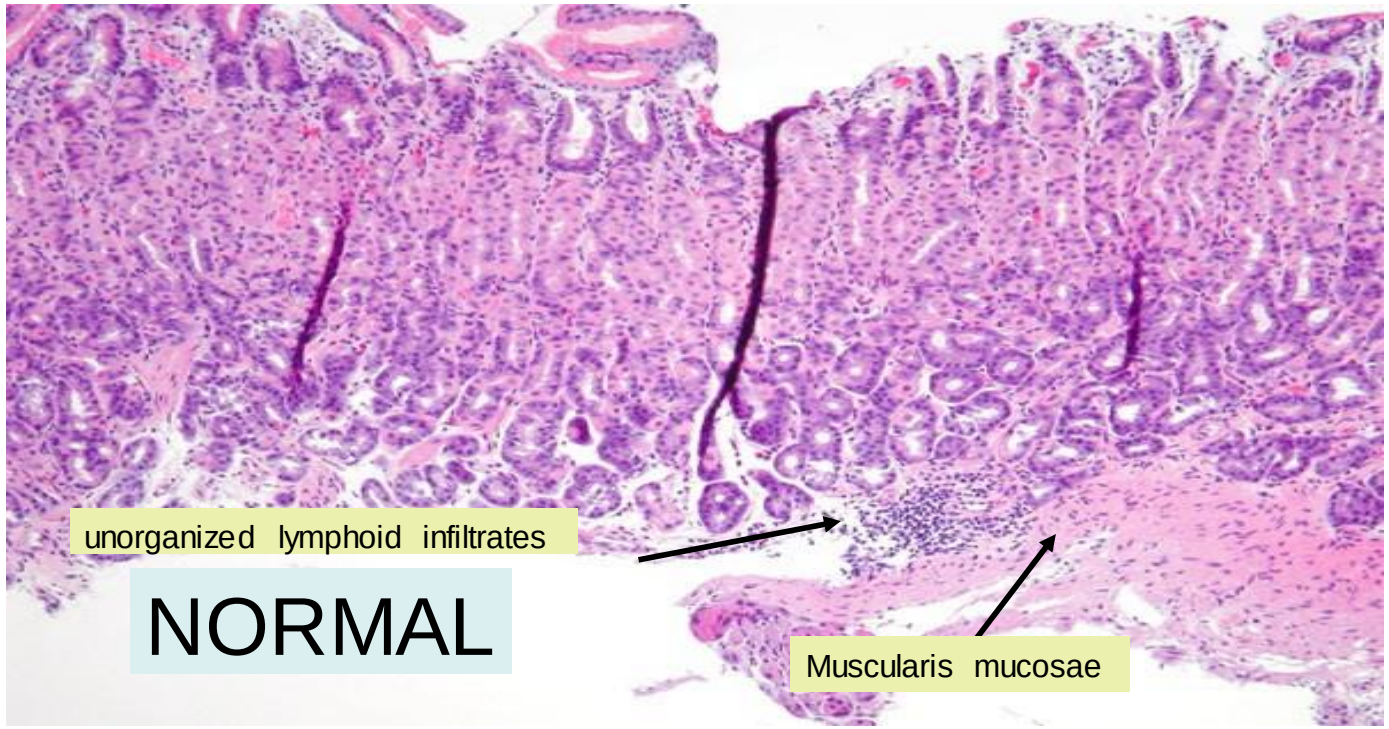
Modified from Gasteroenterologia Polska 2006, 13(1): 7-10

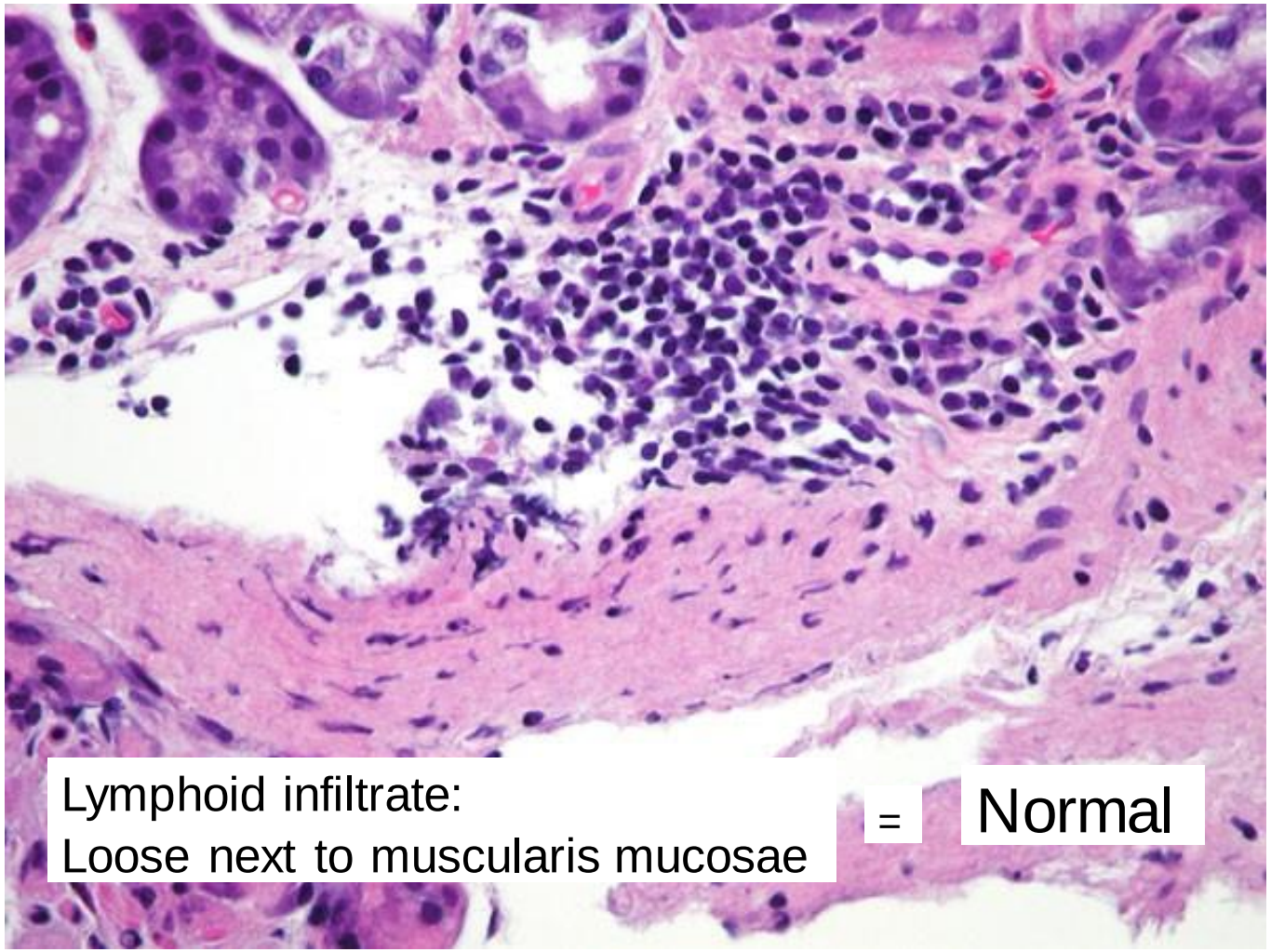
? Clinical relevance



Corpus atrophy presenting as pseudo-pyloric metaplasia instead of intestinal metaplasia

Landmark for NORMAL lymphoid infitrates Musclaris mucosae




Lymphoid infiltrate:
Loose next to muscularis mucosae
=
Normal

OUTLINE

I. Normal stomach

II. Classification of gastritis

III. Specific types of gastritis

IV. How to interpret gastritis

Updated Sydney System 1994

By pattern

Type	Etiology
Non-atrophic	*H. Pylori* Other factors
Atrophic Autoimmune Multifocal	Autoimmune *H. pylori*, dietary, environmental
Special Forms Chemical Lymphocytic Eosinophilic Granulomatous Radiation Other infectious	Chemical irritation Gluten, idiopathic Food sensitivity Crohn's, sarcoid Radiation Virus, fungus, etc.

By etiology

Infectious	1. Bacterial (*H. pylori,* T.B.) 2. Viral (CMV) 3. Fungal (candida) 4. Parasitic
Non-Infectious	1. Chemical/Reflux gastropathy 2. Lymphocytic 3. Auto-immune 4. Inflammatory Bowel Disease 5. Eosinophilic
Part of Systemic involvement	1. GVHD 2. Vasculitis (Churg Struss) 3. Granulomatous 4. collagenous
Miscellaneous	1. Hypertrophic gastropathy 2. Vascular lesions (GAVE, portal gastropathy)

My algorithm at low power

Inflammator: MNC, PMN	1. Diffuse: infectious (+/-*H. pylori*) 2. Focal: IBD, erosion
Non-Inflammatory	1. Epithelial: Reactive (chemical/reflux gastropathy 2. Vascular: GAVE & portal gastropathy
Other	1. Eosinophilic 2. Granulomatous 3. Collagenous

Inflammatory conditions

- Acute gastritis.
- Chronic gastritis.
- Acute gastric ulcer.
- Chronic peptic ulcer.

Acute gastritis and gastropathy

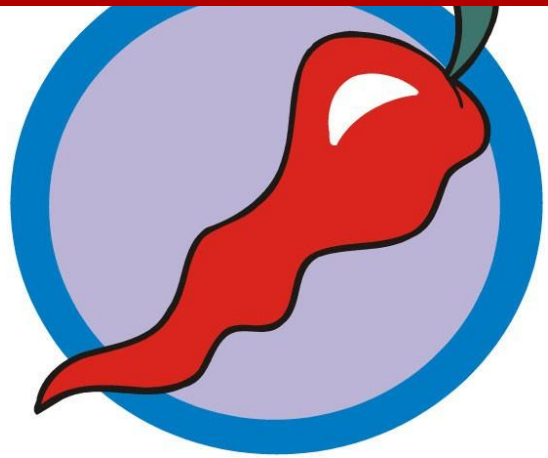
- **Acute gastritis**: Mucosal injury, neutrophils present.
- **Gastropathy**: regenerative, no inflammation.

- **Causes:**
- NSAIDs, alcohol, bile, and stress-induced

- **Clinical features:**
- Asymptomatic, epigastric pain, nausea, vomiting.

Reactive (Chemical/Reflux) Gastropathy

- Originally described by Dixon (1990) with NSAIDs and bile reflux (1986).
- In Bile reflux: The acid causes most of the damage.



CHEMICAL GASTROPATHY

chronic

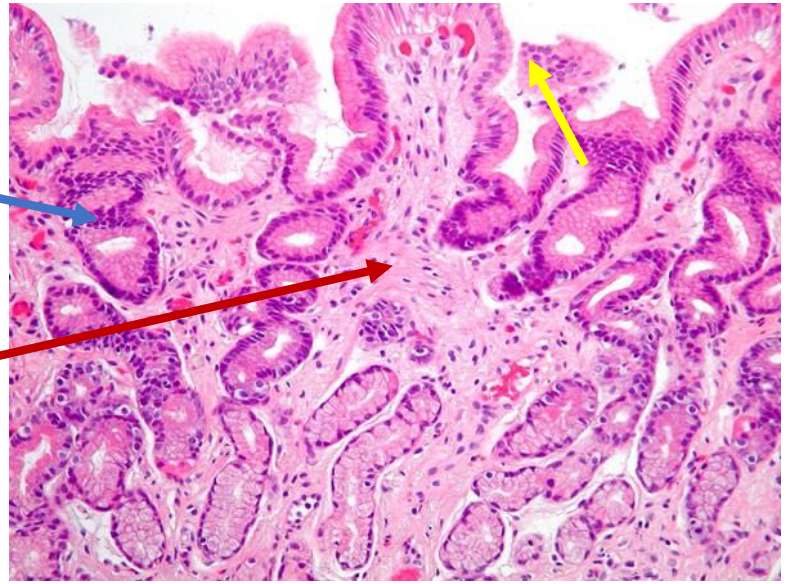
- Triad
  1. Foveolar hyperplasia
  2. Smooth muscle fiber hyperplasia
  3. Paucity of acute and chronic inflammatory cells

acute

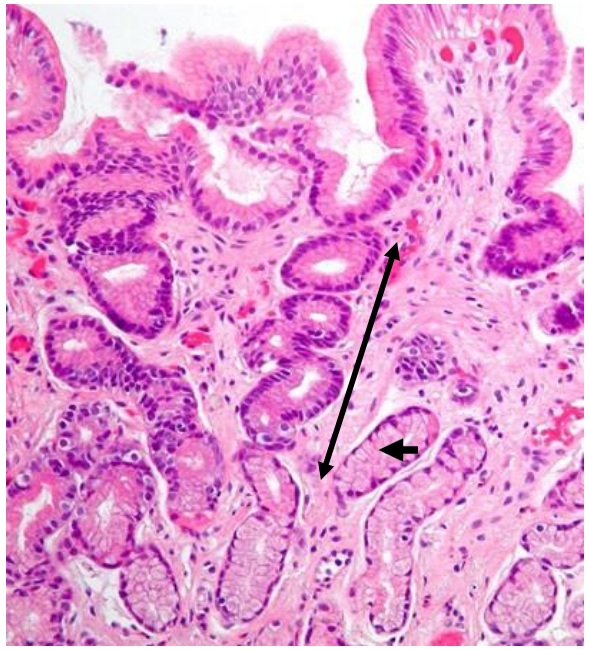
- Other criteria: edema, vasodilation, congestion of capillaries

Reactive/Chemical Gastropathy Triad

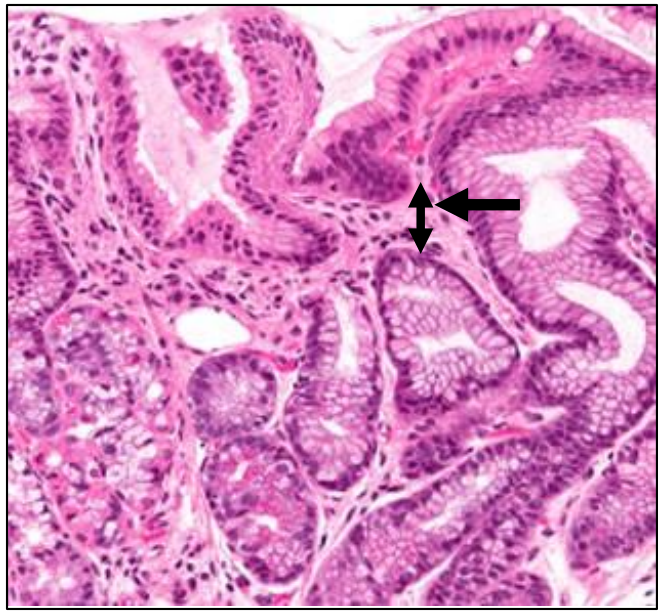
1. Foveolar hyperplasia
2. Smooth muscle fiber hyperplasia
3. Paucity of acute and chronic inflammatory cells



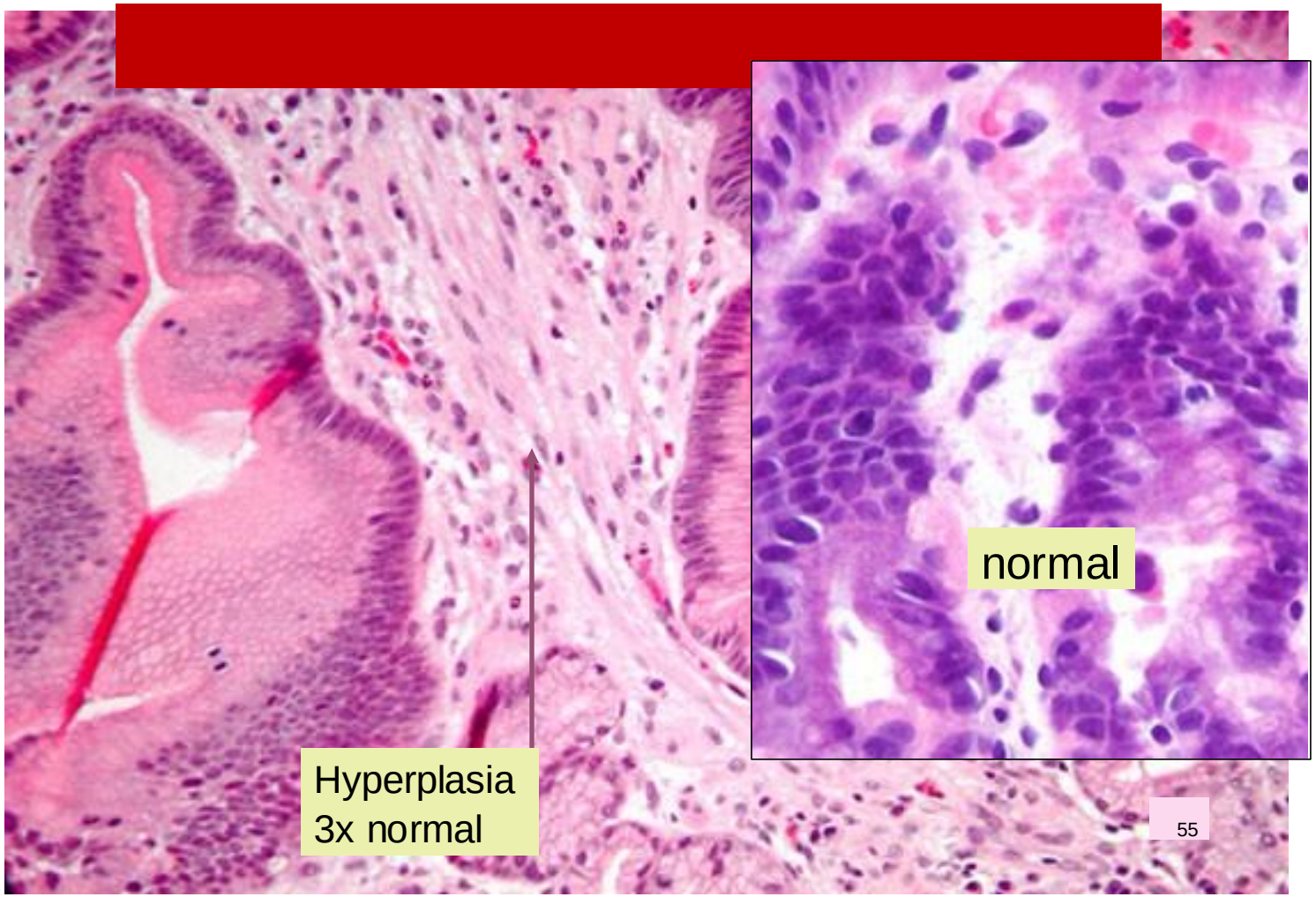
How to identify foveolar hyperplasia?
(length of neck region)

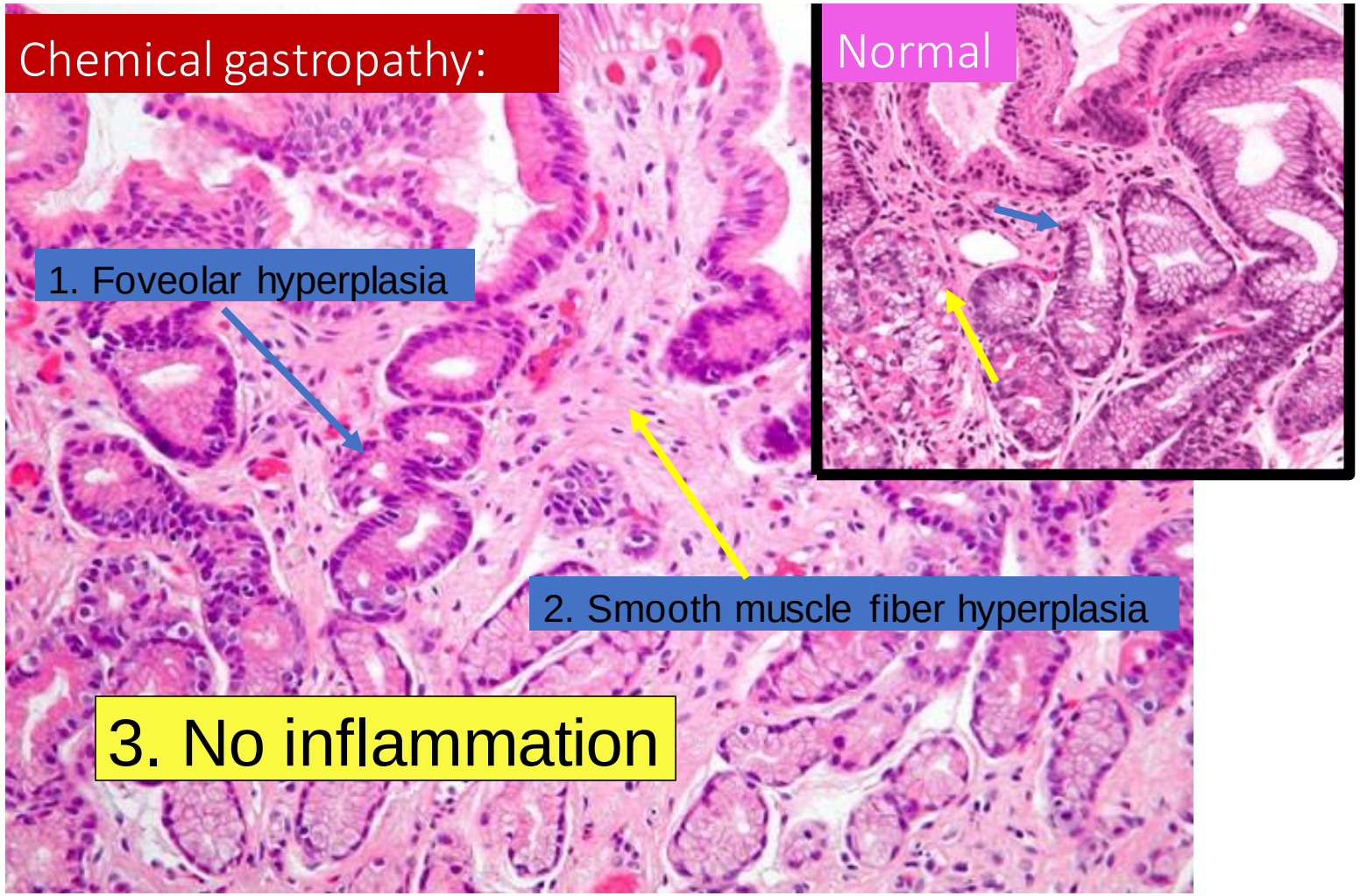


Foveolar hyperplasia
Long & tortuous
Up to 3 x normal



Normal


normal
Hyperplasia
3x normal


Chemical gastropathy:
Normal
1. Foveolar hyperplasia
2. Smooth muscle fiber hyperplasia
3. No inflammation

Chemical Gastropathy: A Distinct Histopathologic Entity in Children

*Dinesh S. Pashankar, *Warren P. Bishop, and †Frank A. Mitros

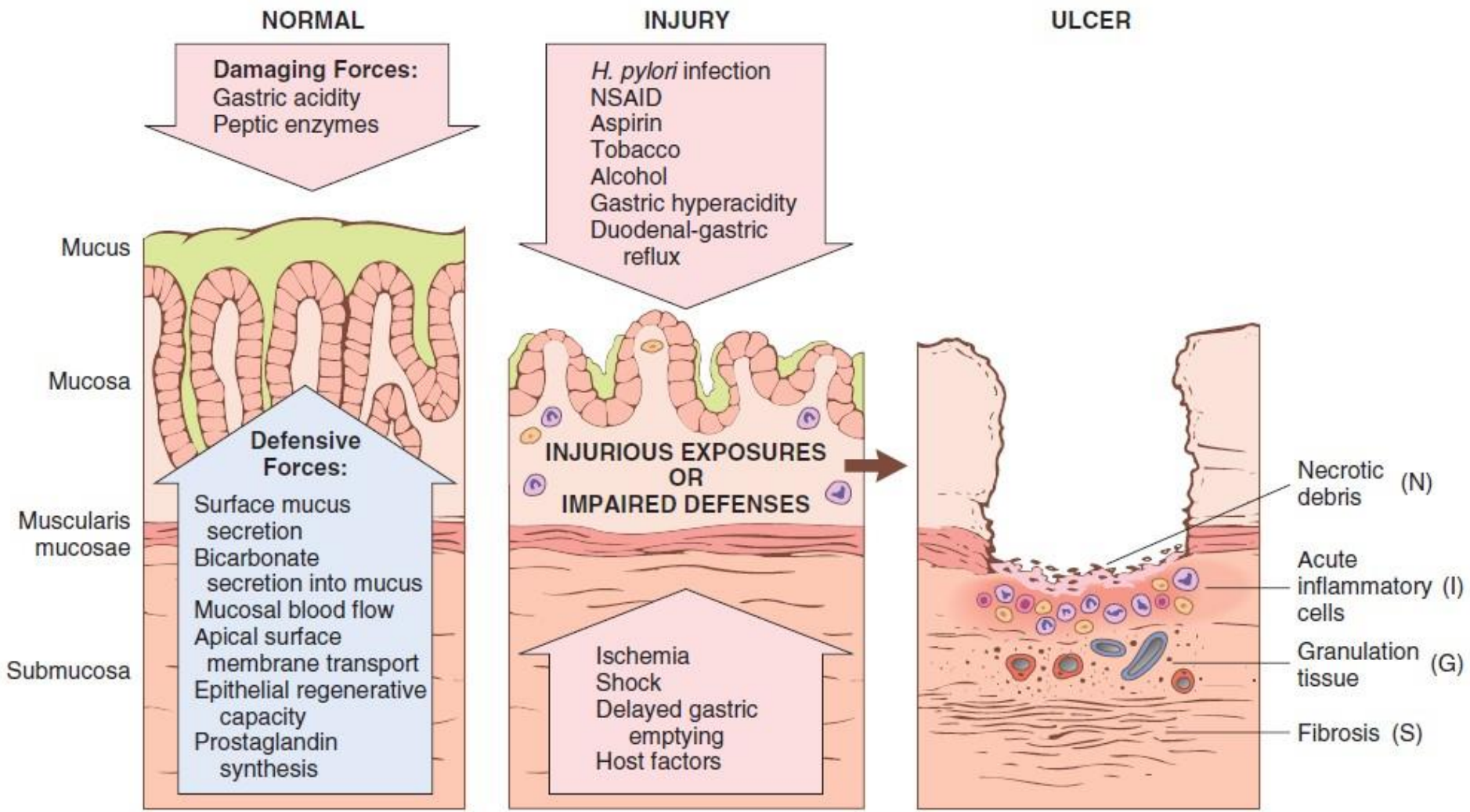
*Division of Gastroenterology, Children's Hospital of Iowa, and †Department of Pathology, University of Iowa, Iowa City, Iowa, U.S.A.

TABLE 2. *Histological features of Dixon's diagnostic scoring system in 21 patients with chemical gastropathy*

Antral histological features	Number	Percent
Foveolar hyperplasia	19	90
Lamia propria edema/smooth muscle fibers	16	76
Vascular congestion	20	95
Paucity of acute inflammatory cells	21	100
Paucity of chronic inflammatory cells	19	90

Journal of Pediatric Gastroenterology and Nutrition
35:653–657 © November 2002 Lippincott Williams & Wilkins, Inc., Philadelphia

Pathogenesis



Robbins Basic Pathology 10th edition

Pathogenesis

- Imbalance between protective and damaging forces

- **Main causes:**

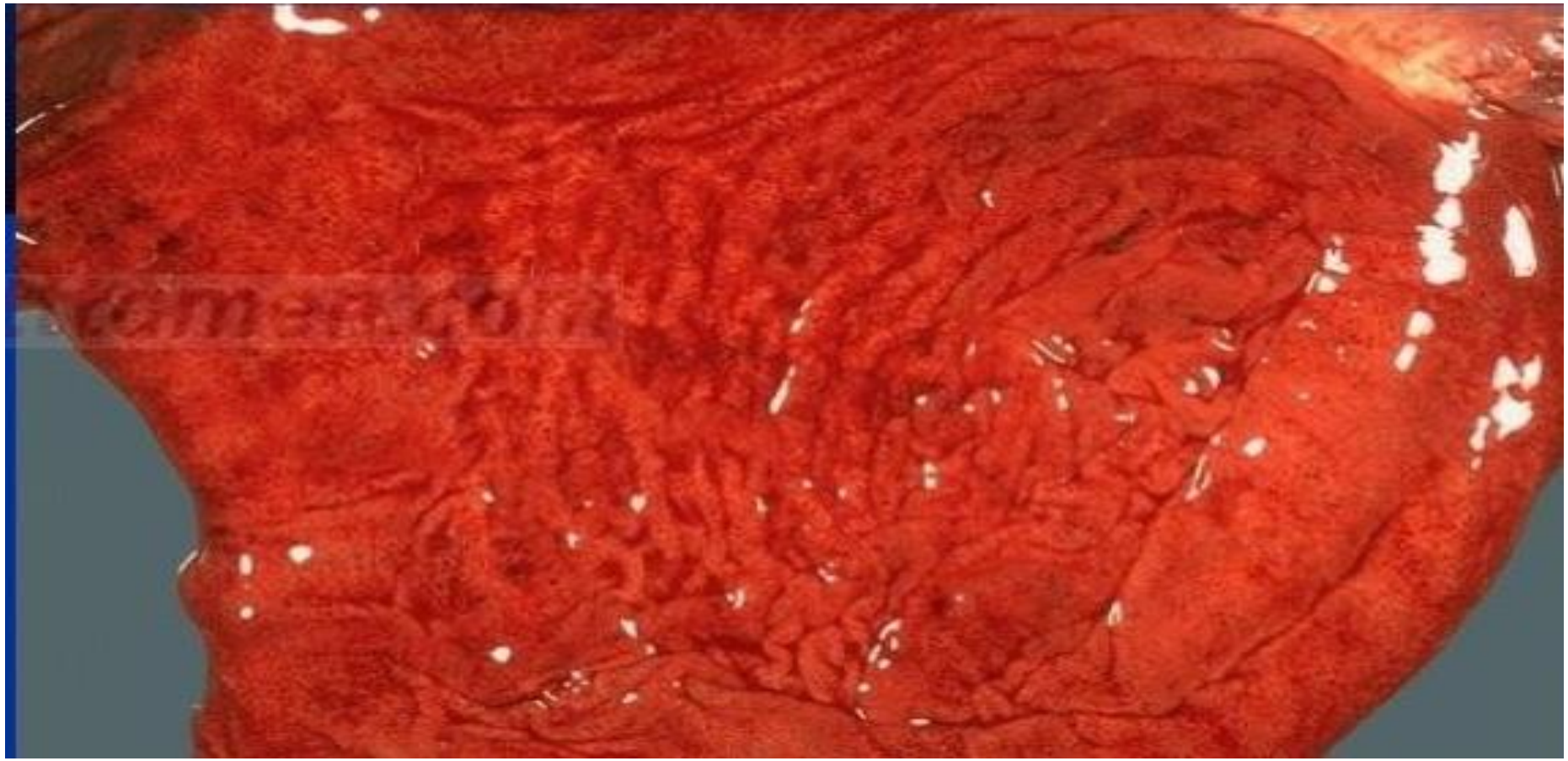
1. **NSAIDs**
2. **Uremic patients, H pylori** infected patients
3. **Old age**.
4. **Hypoxia**
5. **Harsh chemicals**, (acids or bases)
6. **Alcohol, radiation therapy:**
7. **Chemotherapy**.

Morphology

- Hyperemia.
- Edema and slight vascular congestion
- Neutrophils, lymphocytes, and plasma cells are not prominent.
- Intact surface epithelium.
- Advanced: Erosions and hemorrhage, acute erosive hemorrhagic gastritis.

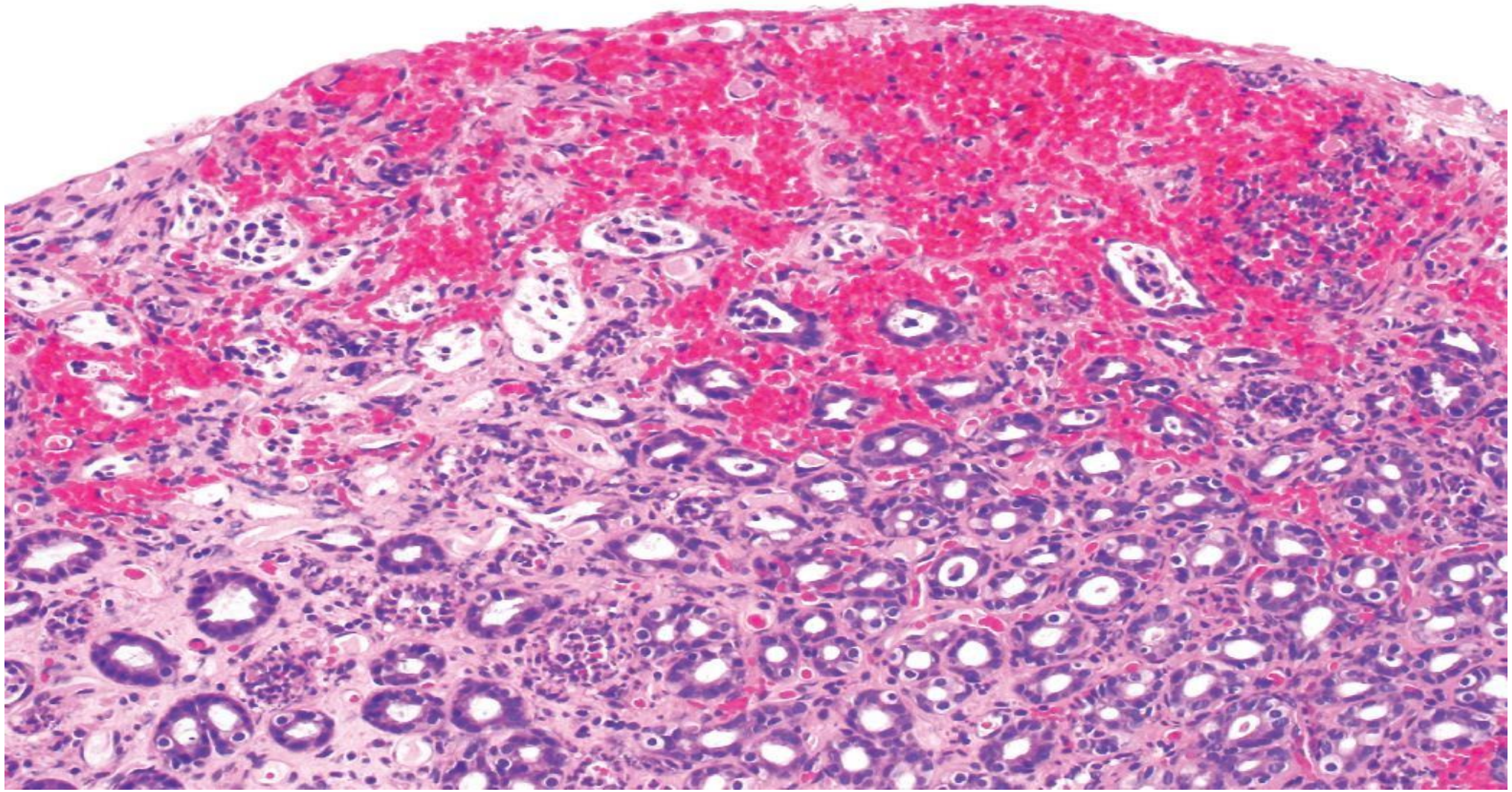
- Active inflammation (neutrophils) is not necessary.

Acute gastritis



www.etttamen.com

B



librepathology.org

Stress-Related Mucosal Disease
acute gastric ulcers

- Severe physiologic stress:

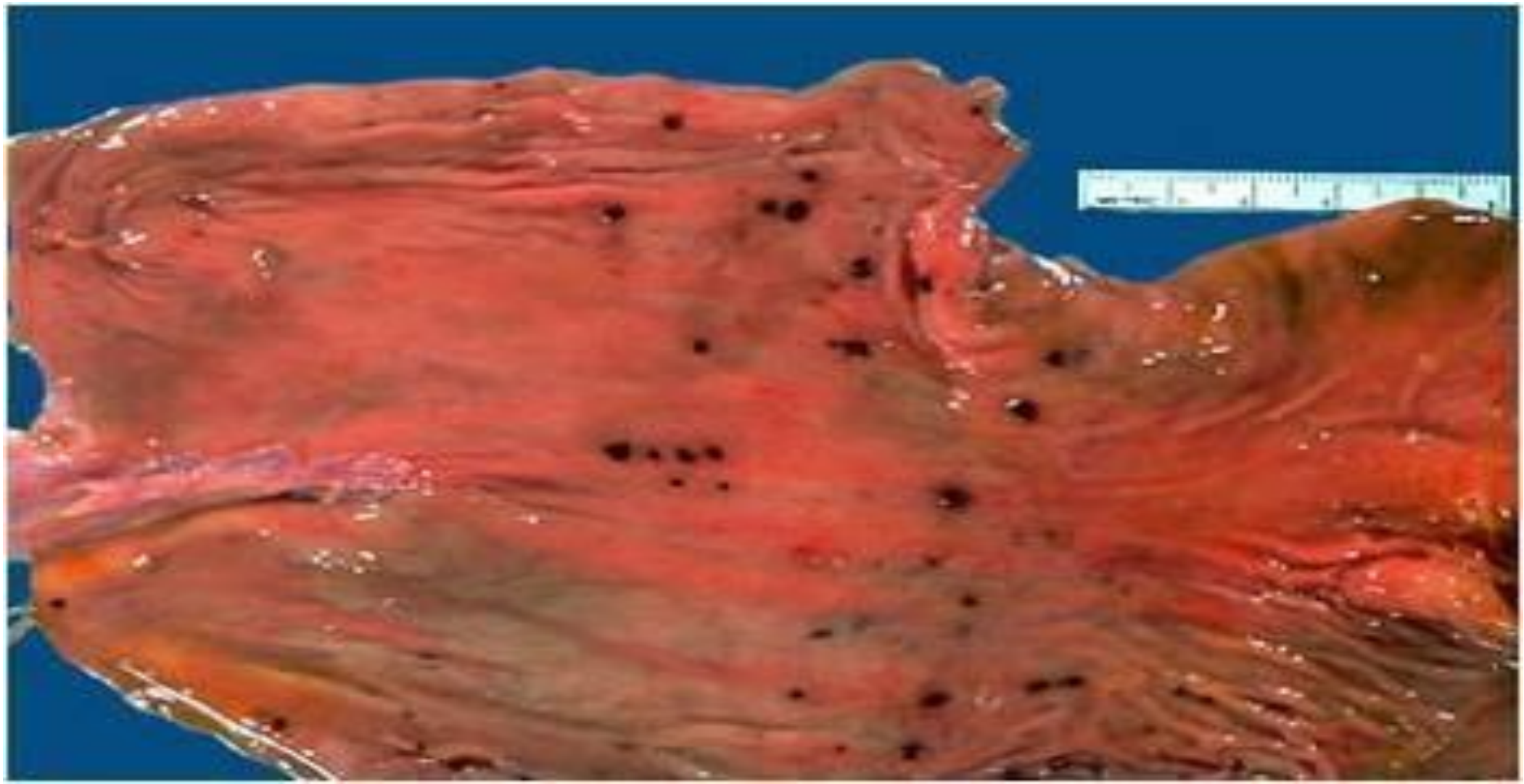
- Trauma
- Extensive burns
- Intracranial disease
- Major surgery
- Serious medical disease
- Critically ill patients

Acute gastric ulcers:

- ***Stress ulcers****:* critically ill patients with shock, sepsis, or severe trauma.
- ***Curling ulcers****:* proximal duodenum , severe burns or trauma.
- ***Cushing ulcers****:* stomach, duodenum, or esophagus, intracranial disease, high risk of perforation.

Morphology

- Acute ulcers are rounded and typically less than 1 cm in diameter
- Shallow to deep.
- Ulcer base brown to black
- Anywhere in stomach
- Usually multiple.
- Normal adjacent mucosa
- No scarring
- Healing with complete reepithelialization occurs days or weeks after removal of injurious factors



Clinical features

- Nausea, vomiting,
- Melena
- Coffee -ground hematemesis
- Perforation complication.

- Prophylaxis with proton pump inhibitors
- Outcome depends on severity of underlying cause.

Chronic gastritis

- *Causes:*

- ***Helicobacter pylori associated gastritis: most common.***
- ***Autoimmune atrophic gastritis: less than 10% of cases.***

- **Less common**
- Chronic NSAID
- Radiation injury
- Chronic bile reflux.

Clinical features

- Nausea and upper-abdominal discomfort
- Vomiting
- Hematemesis uncommon.

- Less severe but more prolonged symptoms.

Diffuse Ghronic Inflammation

H. pylori

1. Gastritis Patterns
2. Special presentations
3. Diagnosis (stains)

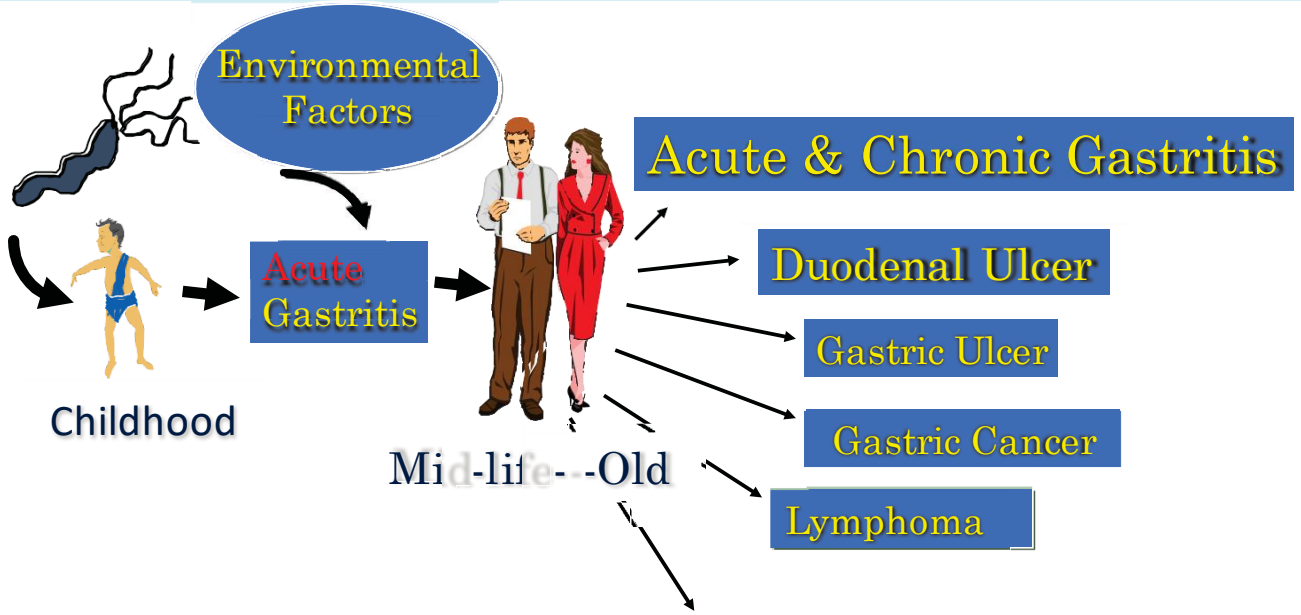
Helicobacter pylori Gastritis

- Discovery of the association of H.pylori *w*ith peptic ulcer disease was a revolution.
- Spiral or curved, G-ve, bacilli.
- Present in almost all duodenal ulcers.
- Majority of gastric ulcers or chronic gastritis.
- Acute infection is subclinical.
- ***Antral gastritis with increased acid production >> peptic ulcer***
- **Intestinal metaplasia and increased risk of gastric cancer.**

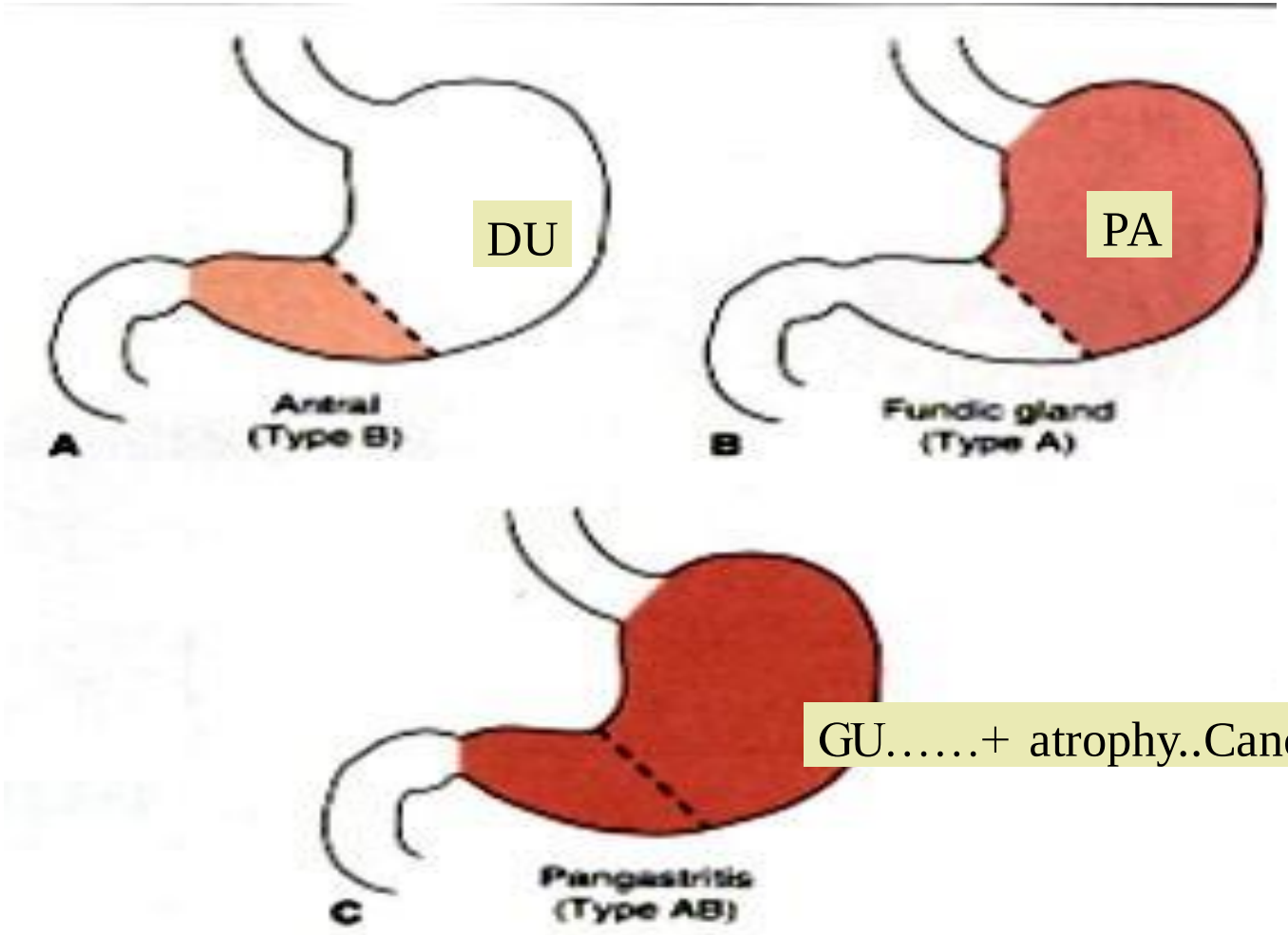
- Poverty, household crowding, limited education, poor sanitation
- Infection is typically acquired in childhood, persists to adult-life.

- **Pathogenesis:**
- H.pylori adapted to live in the mucus layer, non-invasive, by
- **Flagella**: allow motility.
- ***Urease****: split urea to ammonia,* protect bacteria from acidic pH.
- ***Adhesins****:* bacterial adherence to foveolar cells
- ***Toxins****: CagA,* for ulcer or cancer development

OUTCOMES OF *H. PYLORI* INFECTION



GASTRITIS PATTERN



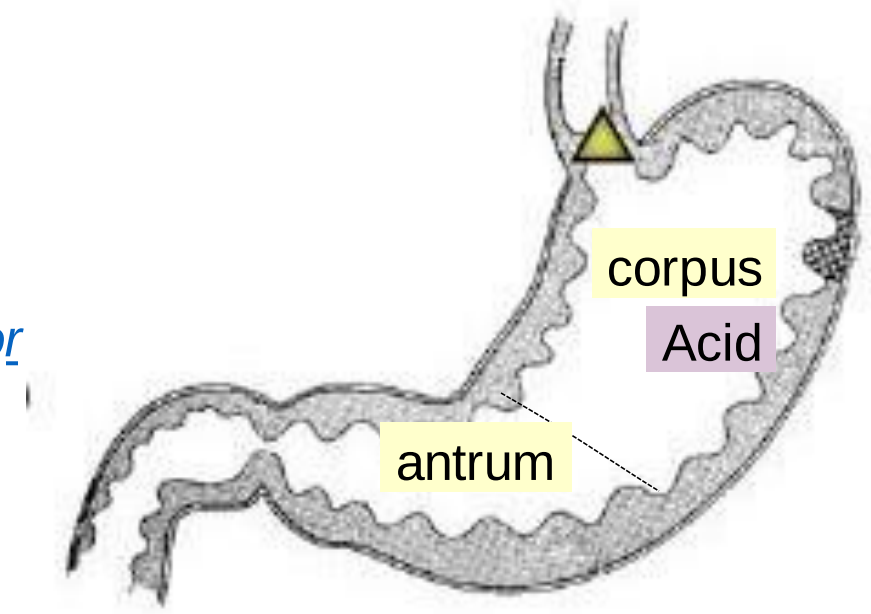
GU……+ atrophy..Cancer

Q: How do we explain different gastritis patterns with H. pylori infection?

Q: How do bugs in the stomach cause ulcers in the duodenum?

No bacteria likes too much acid including *H. pylori*

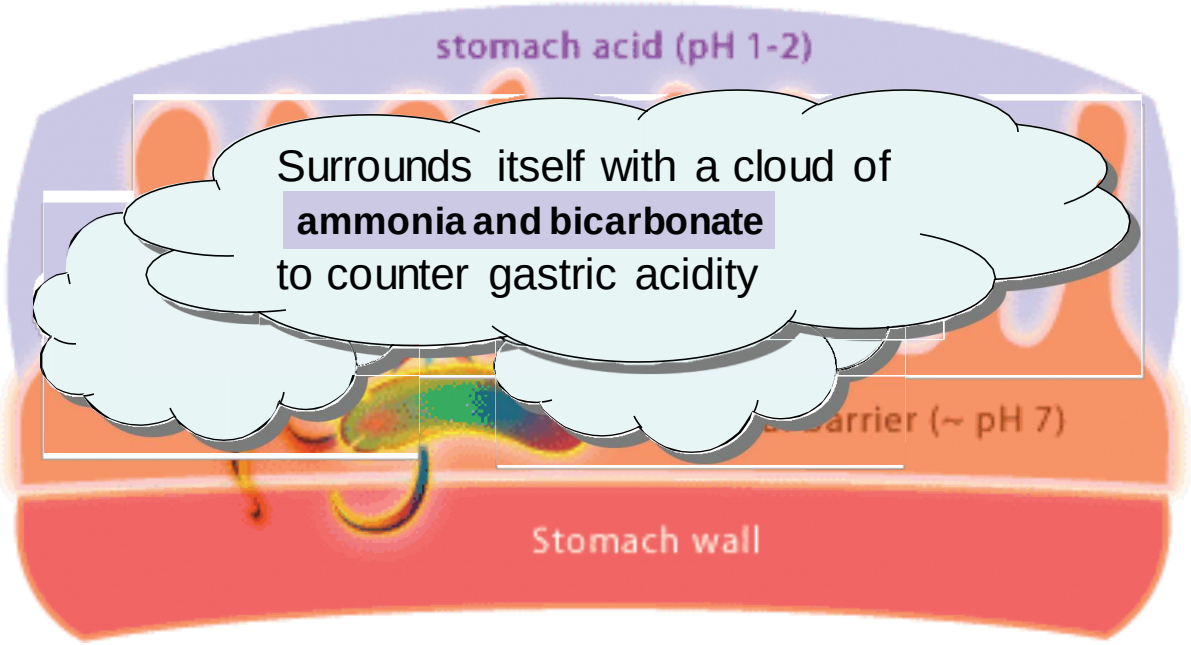
H. pylori prefers neutral pH and dies below 4.0 or above 8.2



H. pylori starts its life in the antrum where it is less acidic

No bacteria likes acid

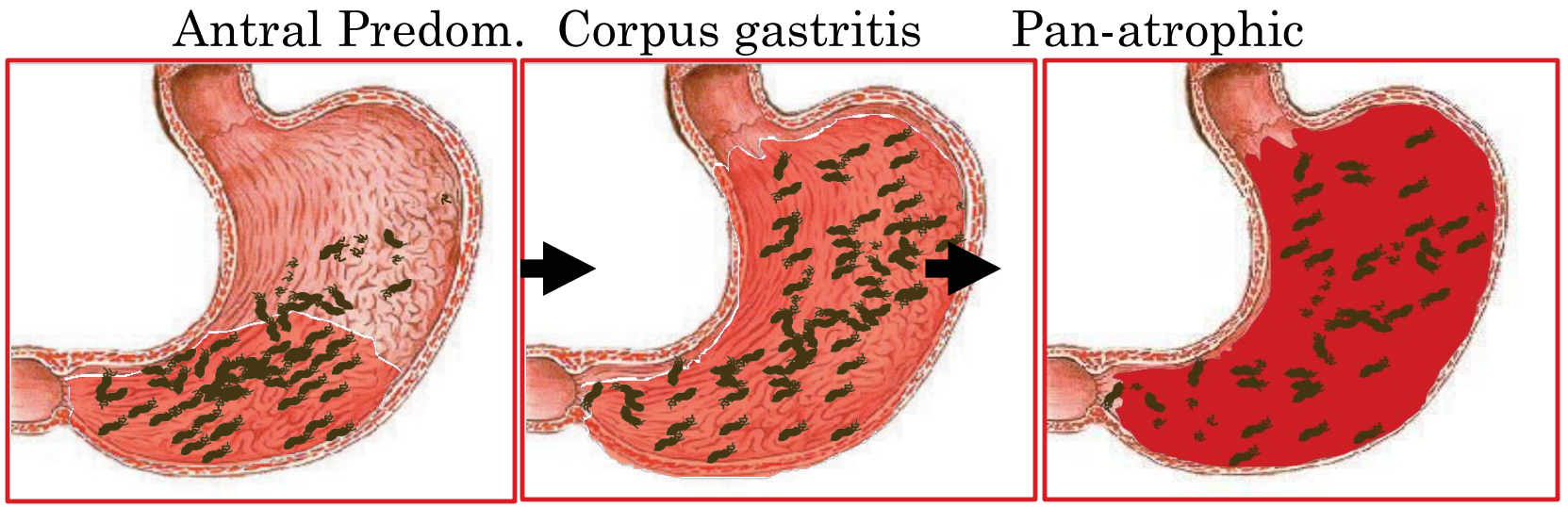
Starts in the antrum



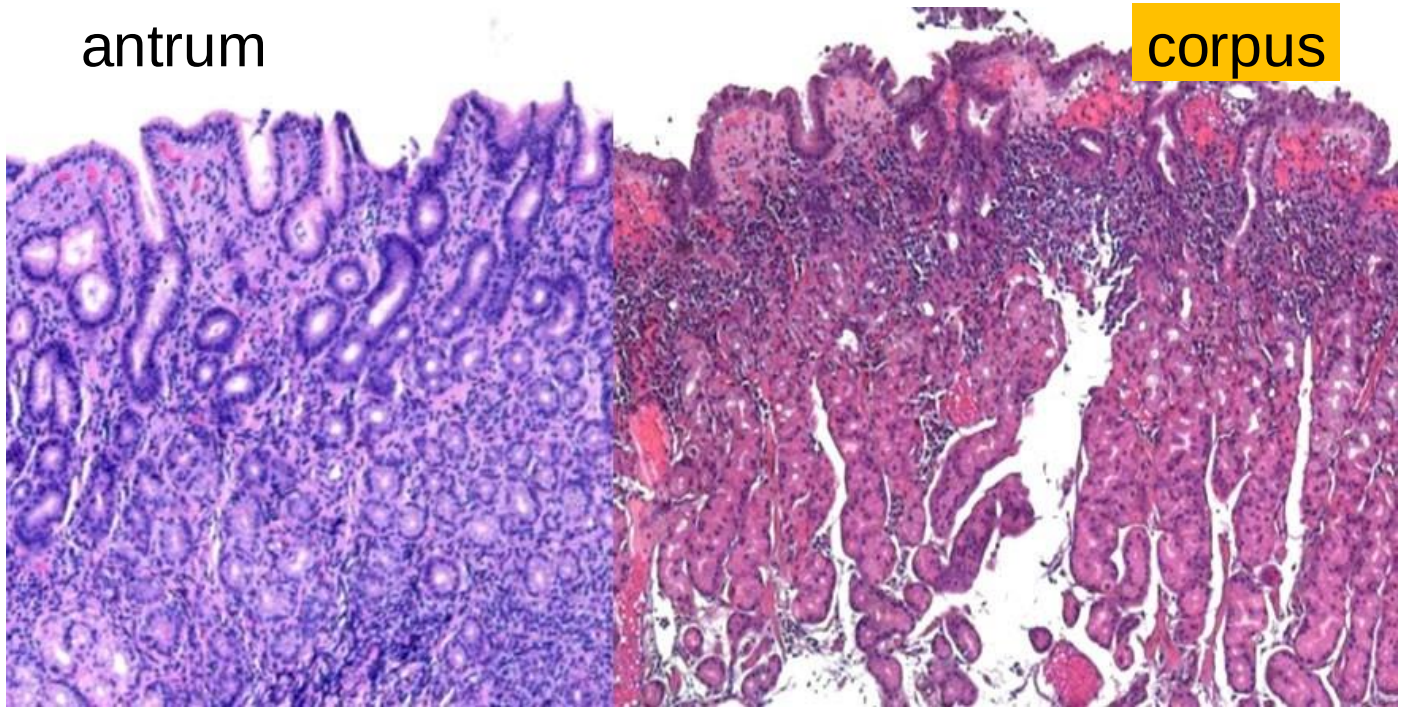
(it produces urease which converts urea (abundant in saliva & gastric juices) to ammonia and bicarbonate)

$C=O(NH_2)_2 + H^+ + 2H_2O$ --urease--> $HCO_3^- + 2(NH_4)^+$

Gastritis Stages
proximal migration of *H. pylori*

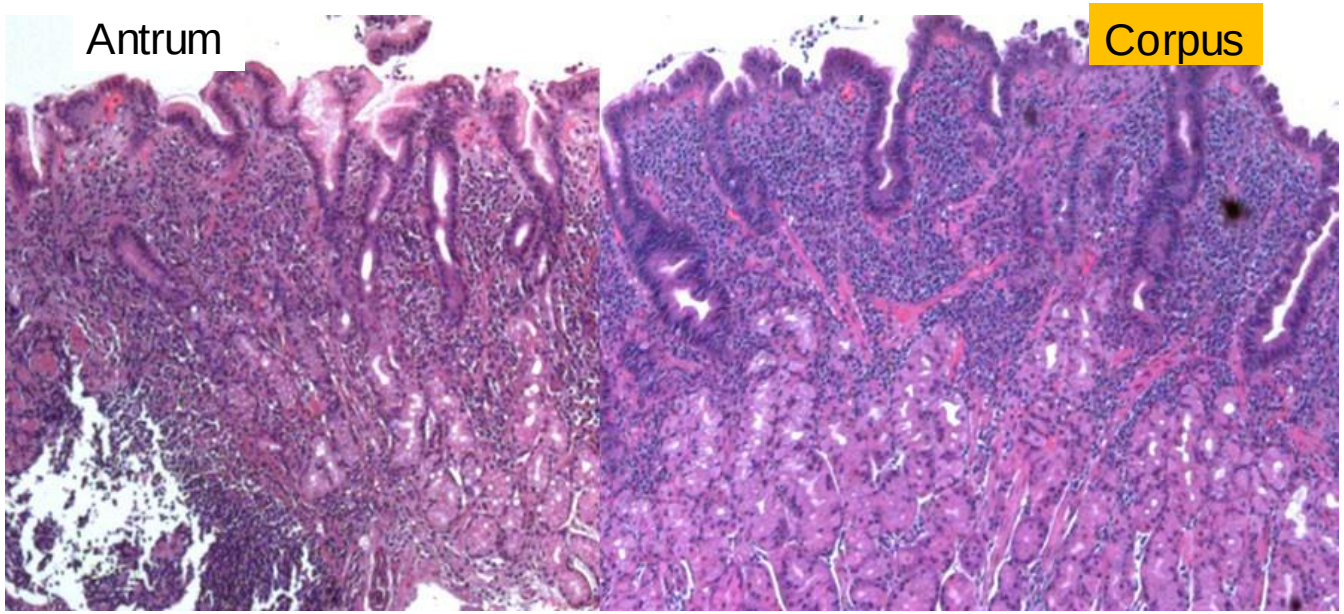


Sustained H. Pylori Gastritis



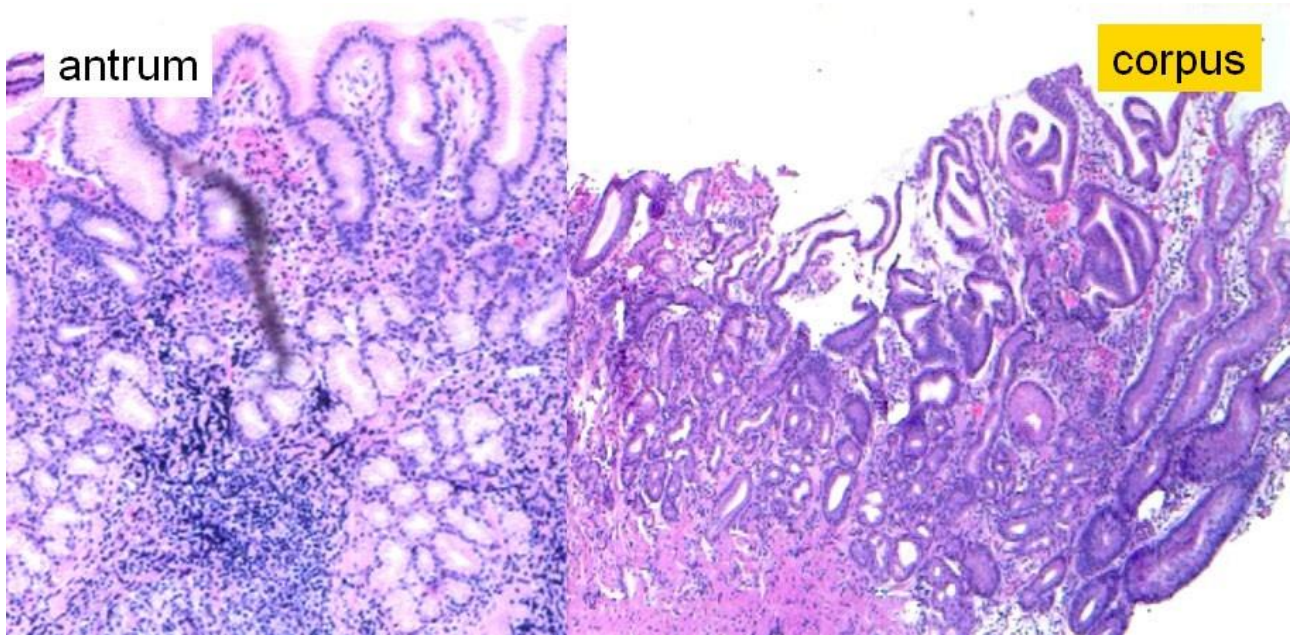
Pan Gastritis with superficial inflammation in the corpus

And later H. Pylori Gastritis



Pan-Gastritis with deeper inflammation in ! corpus

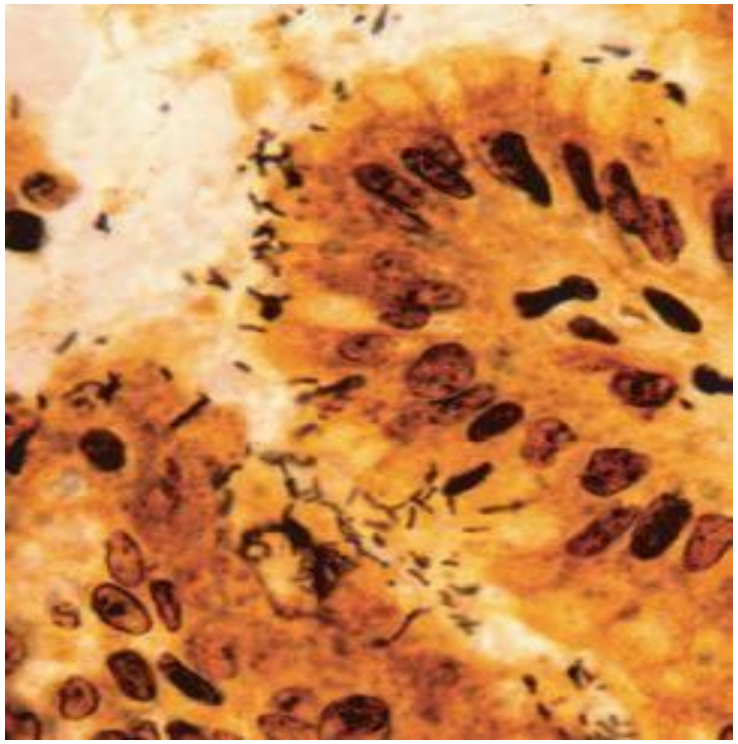
Too Late H. Pylori gastritis

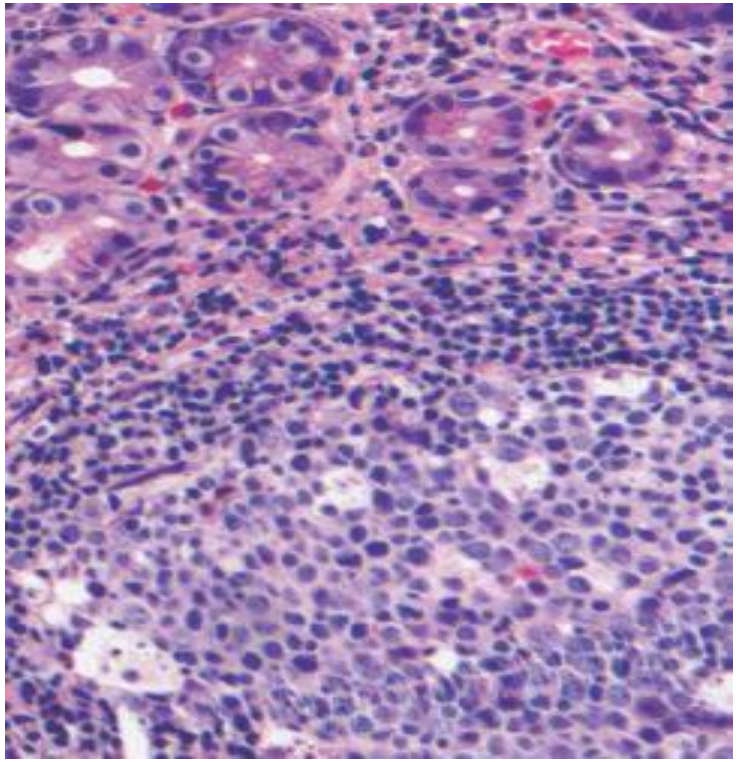


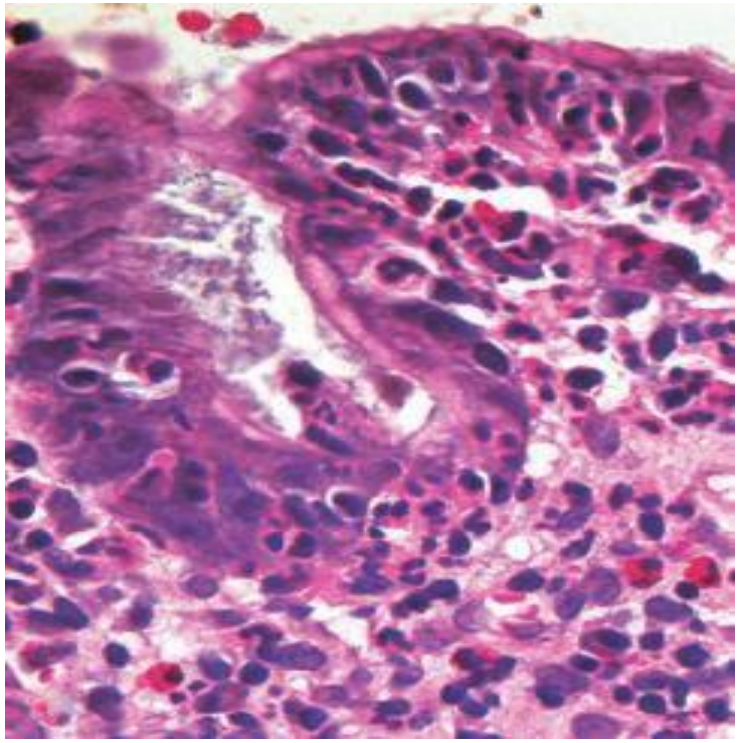
Pan Gastritis with corpus atrophy
With increased risk for gastric carcinoma

Morphology

- Gastric biopsy: H. pylori in mucus layer, antrum.
- Neutrophils within the lamina propria
- Plasma cells, lymphocytes & macrophages.
- **Lymphoid aggregates>>> increased risk of MALT lymphoma.**
- **Intestinal metaplasia (goblet cells)>>> dysplasia >> increased risk of adenocarcinoma**

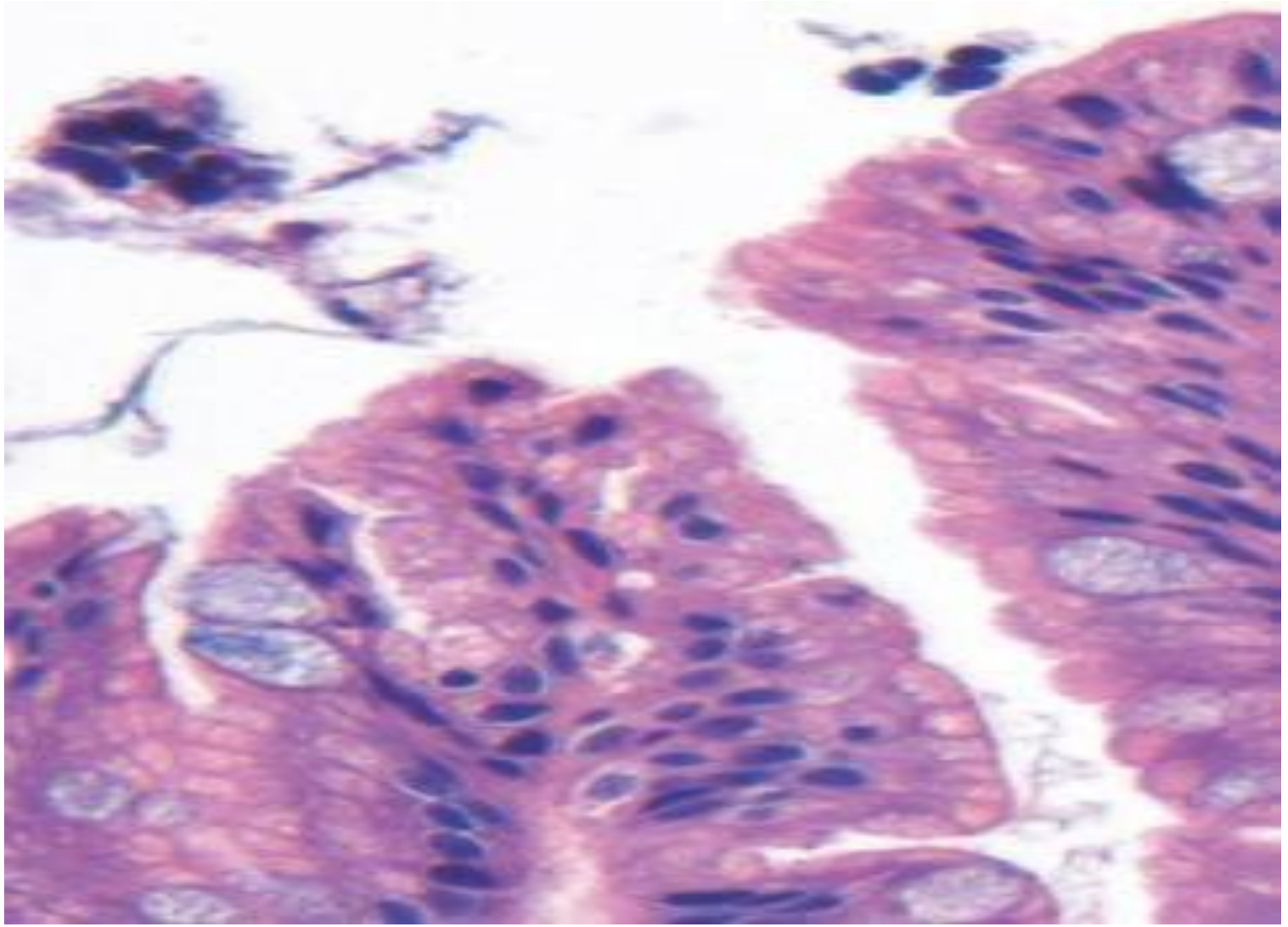






Robbins Basic Pathology 10th edition

Intestinal metaplasia



Robbins Basic Pathology 10th edition

Diagnosis and treatment

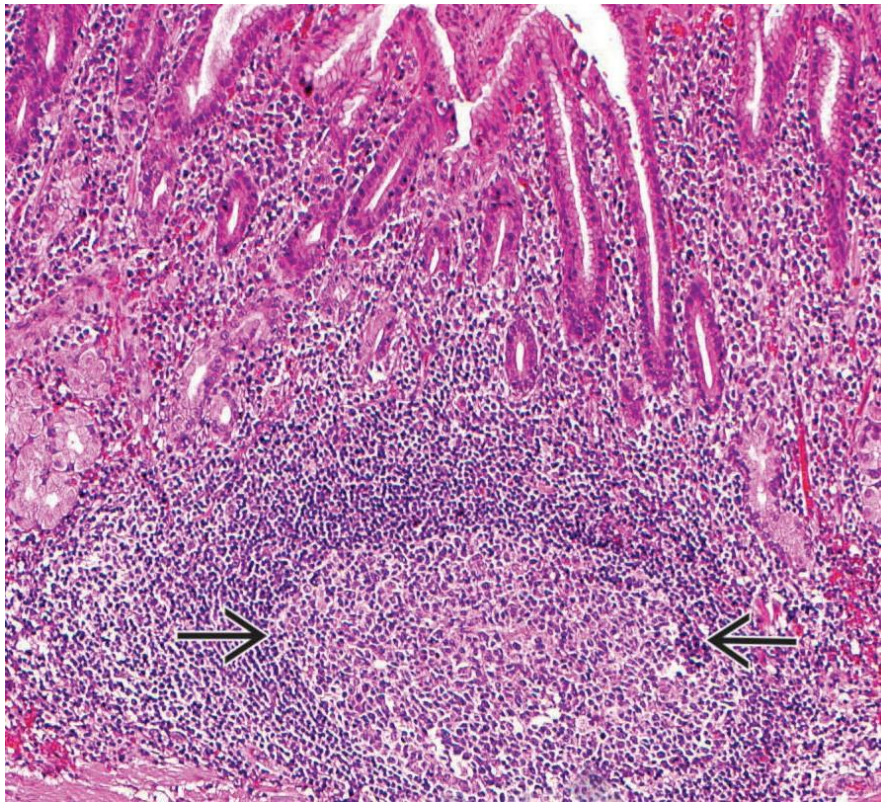
- Serologic test: anti-H .pylori antibodies.
- Stool test for H.pylori.
- Urea breath test.

- Gastric biopsy
- Bacterial culture.
- PCR test for bacterial DNA.

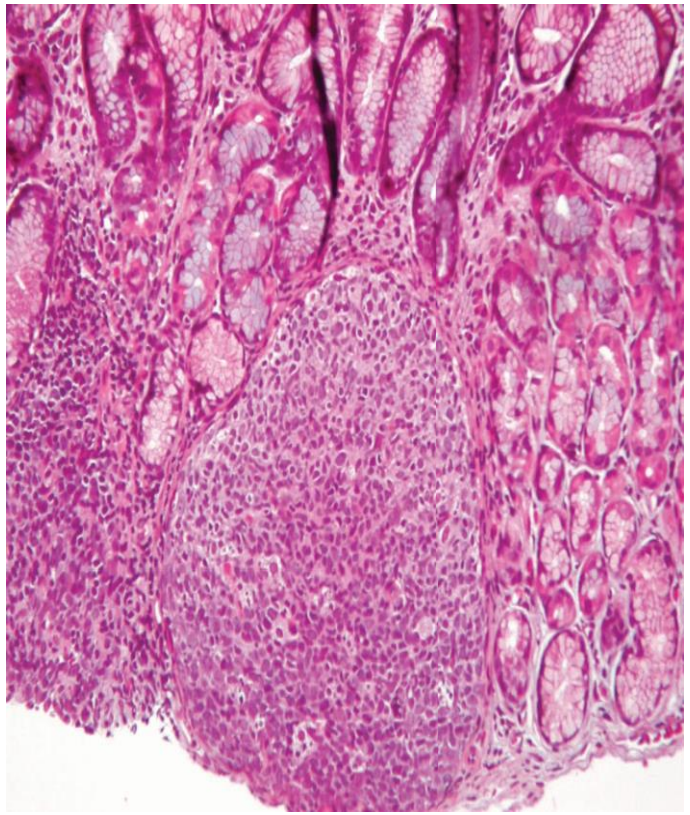
- Treatment: combinations of antibiotics and PPI.

Lymphoid Follicles in *H. pylori* infection

Pre-treatment



Post treatment



Autoimmune Gastritis

- Antibodies to parietal cells and intrinsic factor in serum.
- Reduced serum pepsinogen I levels
- Antral endocrine cell hyperplasia
- Vitamin B12 deficiency >>> pernicious anemia and neurologic changes
- Impaired gastric acid secretion (*achlorhydria)*
- Spares the antrum.
- Marked *hypergastrinemia*

Pathogenesis

- Immune-mediated loss of parietal cells >>> reductions in acid and intrinsic factor secretion.
- Acid reduction leads to hypergastrinemia
- Hyperplasia of antral G cells
- Deficient intrinsic factor >> deficient ileal VB12 absorption >> megaloblastic anemia.
- Some chief cell damage >> reduced pepsinogen

Morphology

- Damage of the oxyntic (acid-producing) mucosa.
- Diffuse atrophy, thinning of wall, loss of rugal folds
- Lymphocytes, plasma cells, macrophages, less likely neutrophils.
- Intestinal metaplasia >>> dysplasia >> carcinoma.
- Neuroendocrine cell hyperplasia >>> tumors.

Clinical features

- 60 years, slight female predominance.
- Often associated with other autoimmune diseases

Table 15.2 Characteristics of *Helicobacter pylori*–Associated and Autoimmune Gastritis

Feature	*H. pylori*–Associated	Autoimmune
Location	Antrum	Body
Inflammatory infiltrate	Neutrophils, subepithelial plasma cells	Lymphocytes, macrophages
Acid production	Increased to slightly decreased	Decreased
Gastrin	Normal to markedly increased	Markedly increased
Other lesions	Hyperplastic/inflammatory polyps	Neuroendocrine hyperplasia
Serology	Antibodies to *H. pylori*	Antibodies to parietal cells (H^+,K^+-ATPase, intrinsic factor)
Sequelae	Peptic ulcer, adenocarcinoma, lymphoma	Atrophy, pernicious anemia, adenocarcinoma, carcinoid tumor
Associations	Low socioeconomic status, poverty, residence in rural areas	Autoimmune disease; thyroiditis, diabetes mellitus, Graves disease

Robbins Basic Pathology 10th edition