How do we stomach our food?

Part 2 – Control of gastric secretion

Prof. Barry Campbell

Infection Biology & Microbiomes, IVES

bjcampbl@liv.ac.uk
http://pcwww.liv.ac.uk/~bjcampbl/Indigestion%201.htm

Part 2 –
Control of gastric secretion

Learning Outcomes:

- LO1 - Differentiate between the motility of proximal and distal stomach (receptive relaxation, gastric accommodation, reservoir function, propulsion, grinding and retropulsion)

- LO2 - Define and describe the composition and function of gastric secretions (acid, pepsinogens/pepsin, intrinsic factor, mucus, gastric lipase)

- LO3 - Define the cellular mechanisms of gastric acid secretion (i.e. gastric parietal cells and the proton pump)

- **LO4 - Differentiate between the three phases in gastric secretion in response to ingestion of a meal**

- **LO5 - Explain what is hyper-acid secretion, introduce the role/importance of the *Helicobacter pylori* as a cause of gastric disease and mechanisms of gastric acid blockade.**

LO4

The vagus nerve, appetite & acid

I P Pavlov

Nobel Prize, 1904 ...
in recognition of his work on the physiology of digestion

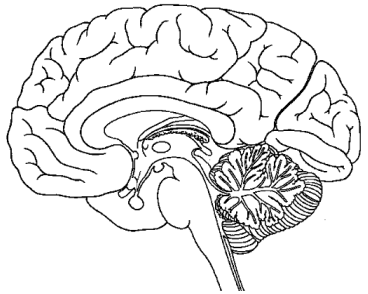
"Appetite spells gastric juice" .....

gastric juice marketed for the stimulation of poor appetite

LO4

Classical Phases of Gastric Acid Secretion

Triggers are from higher centres

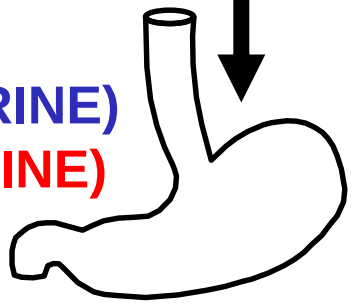


1. Cephalic phase

Thought, sight, smell, taste
→ Ach, GRP (NEURAL)

Vagus nerve

Indirect action:
Ach → histamine (PARACRINE)
GRP → Gastrin (ENDOCRINE)



Empty stomach

GRP = gastrin releasing peptide

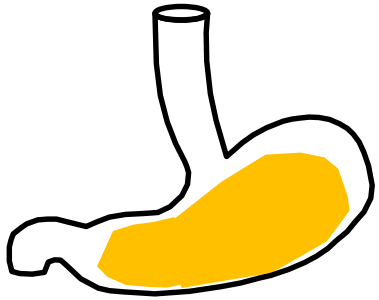
LO4

Classical Phases of Gastric Acid Secretion

Distension of stomach

Ach (NEURAL – intrinsic nerves)

Food in stomach

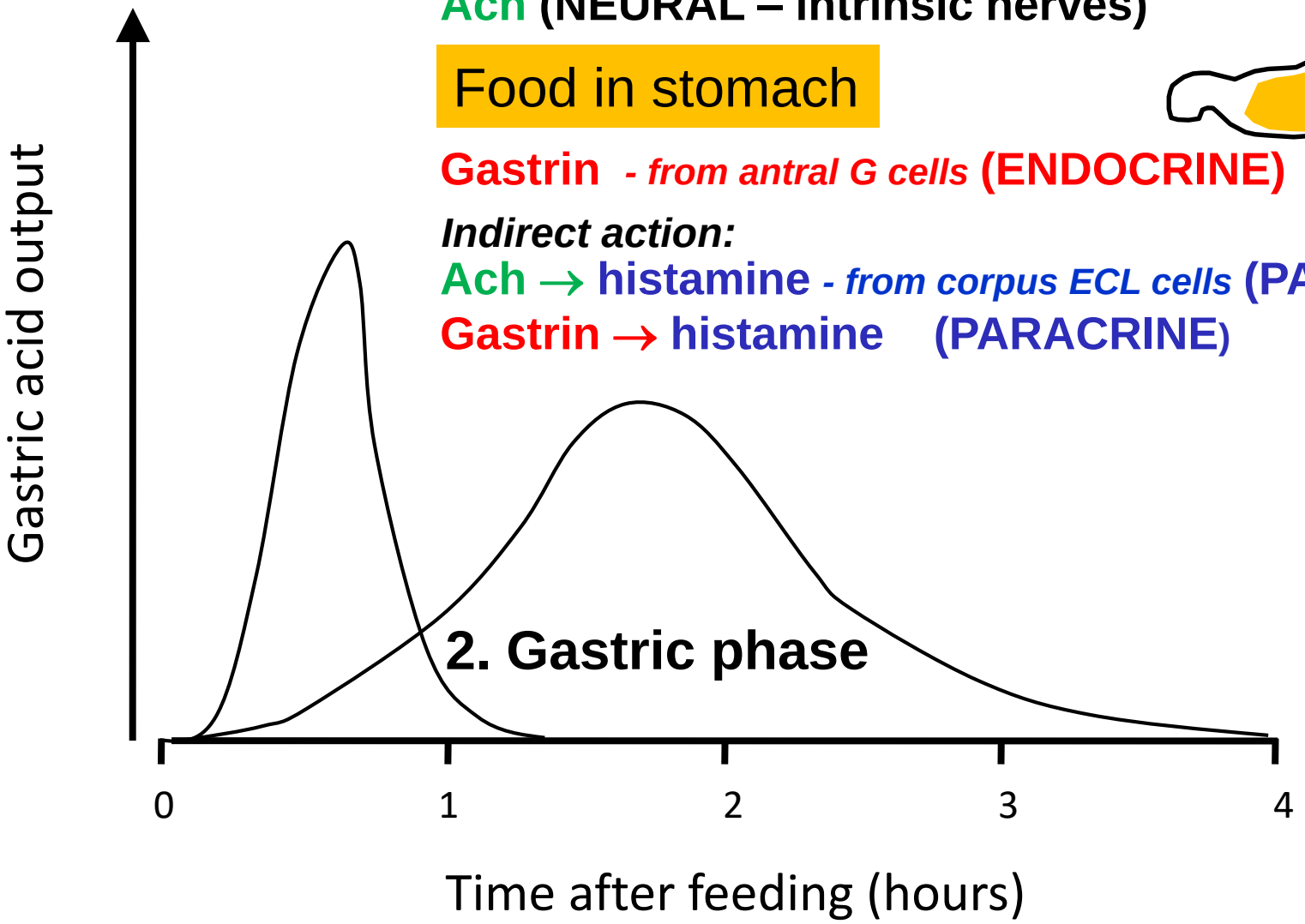


Gastrin ***- from antral G cells*** **(ENDOCRINE)**

Indirect action:

Ach → histamine ***- from corpus ECL cells*** **(PARACRINE**

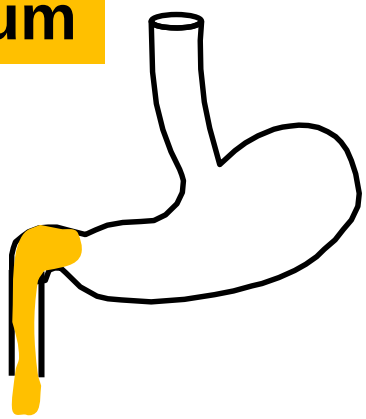
Gastrin → histamine (PARACRINE)



LO4

Classical Phases of Gastric Acid Secretion

Distension/Food in duodenum



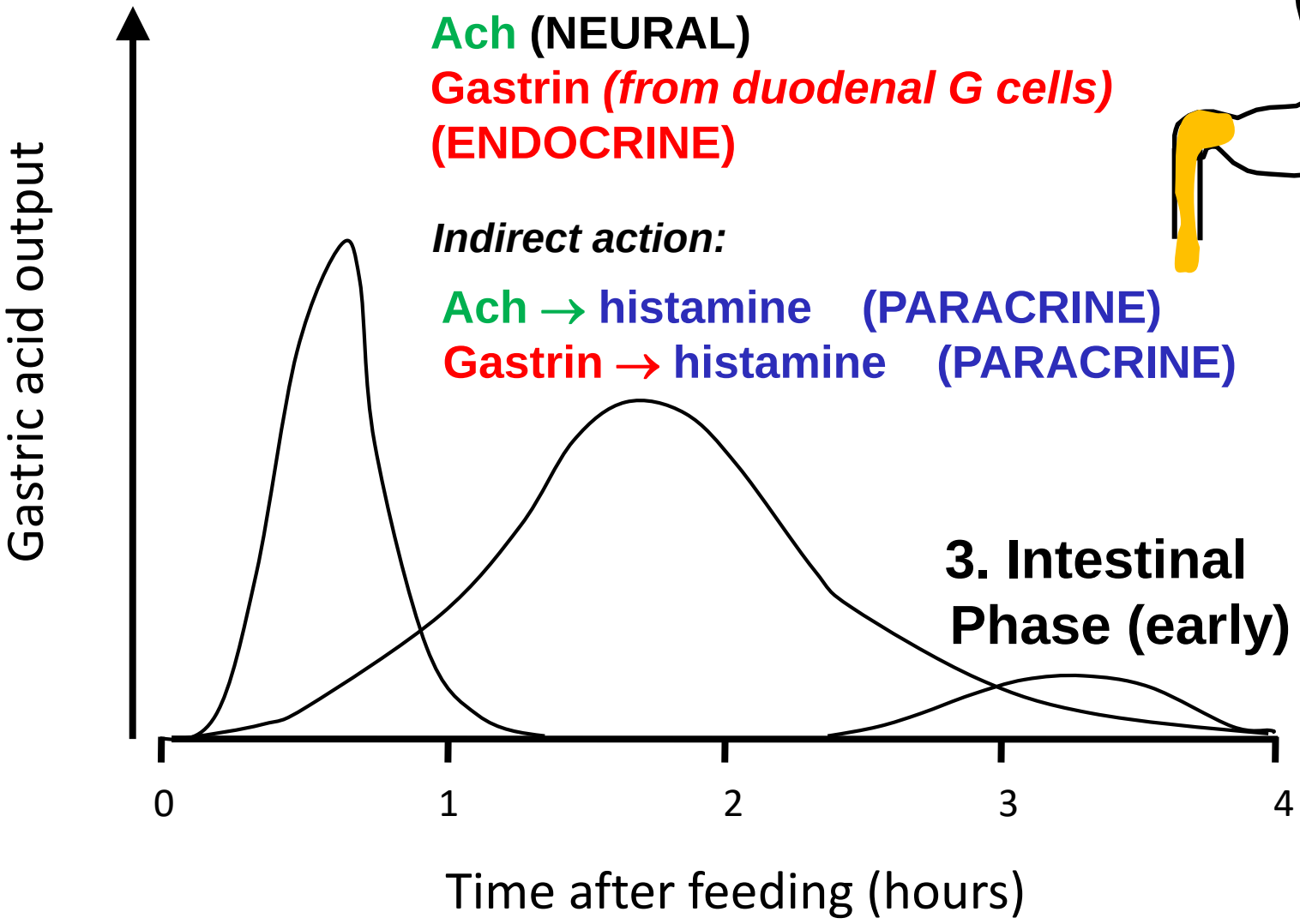
Ach (NEURAL)

Gastrin *(from duodenal G cells)* (ENDOCRINE)

Indirect action:

Ach → histamine (PARACRINE)

Gastrin → histamine (PARACRINE)

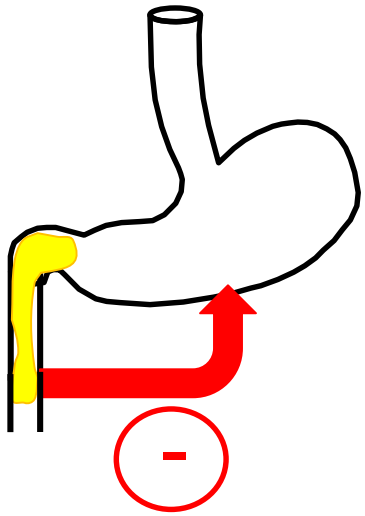


3. Intestinal Phase (early)

LO4

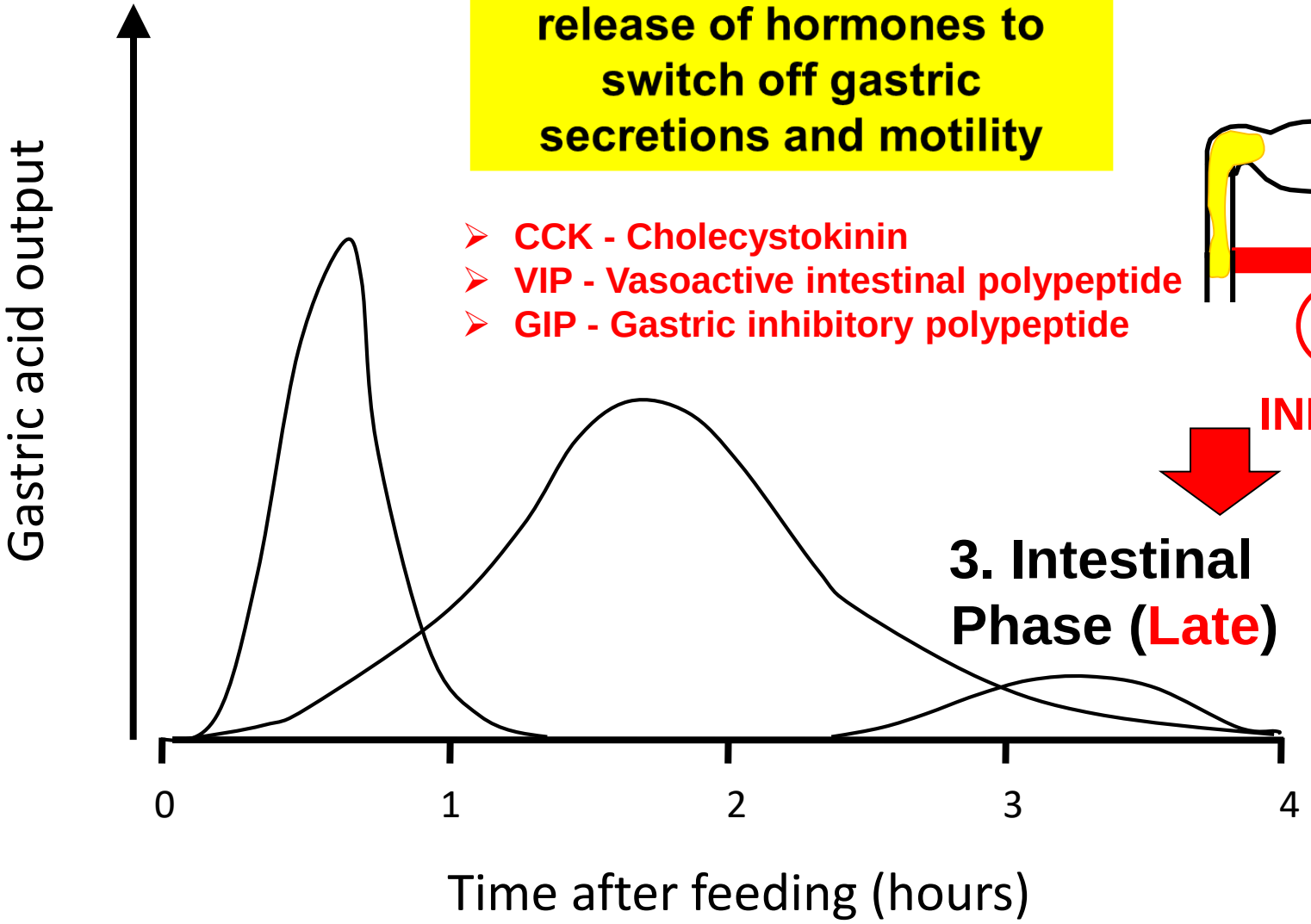
Classical Phases of Gastric Acid Secretion

Fat-rich chyme entering the duodenum results in release of hormones to switch off gastric secretions and motility



INHIBITION

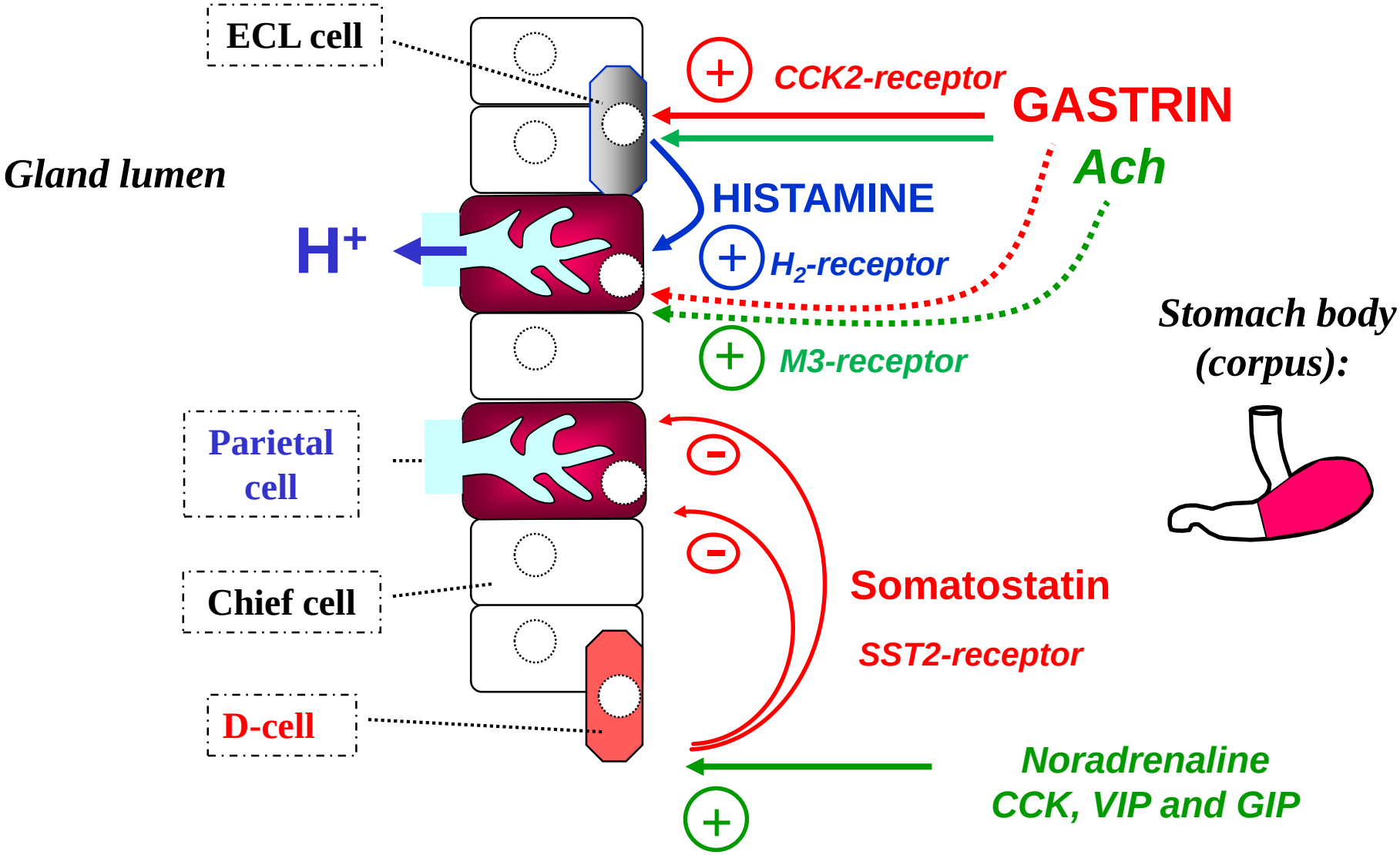
- **CCK - Cholecystokinin**
- **VIP - Vasoactive intestinal polypeptide**
- **GIP - Gastric inhibitory polypeptide**



3. Intestinal Phase (Late)

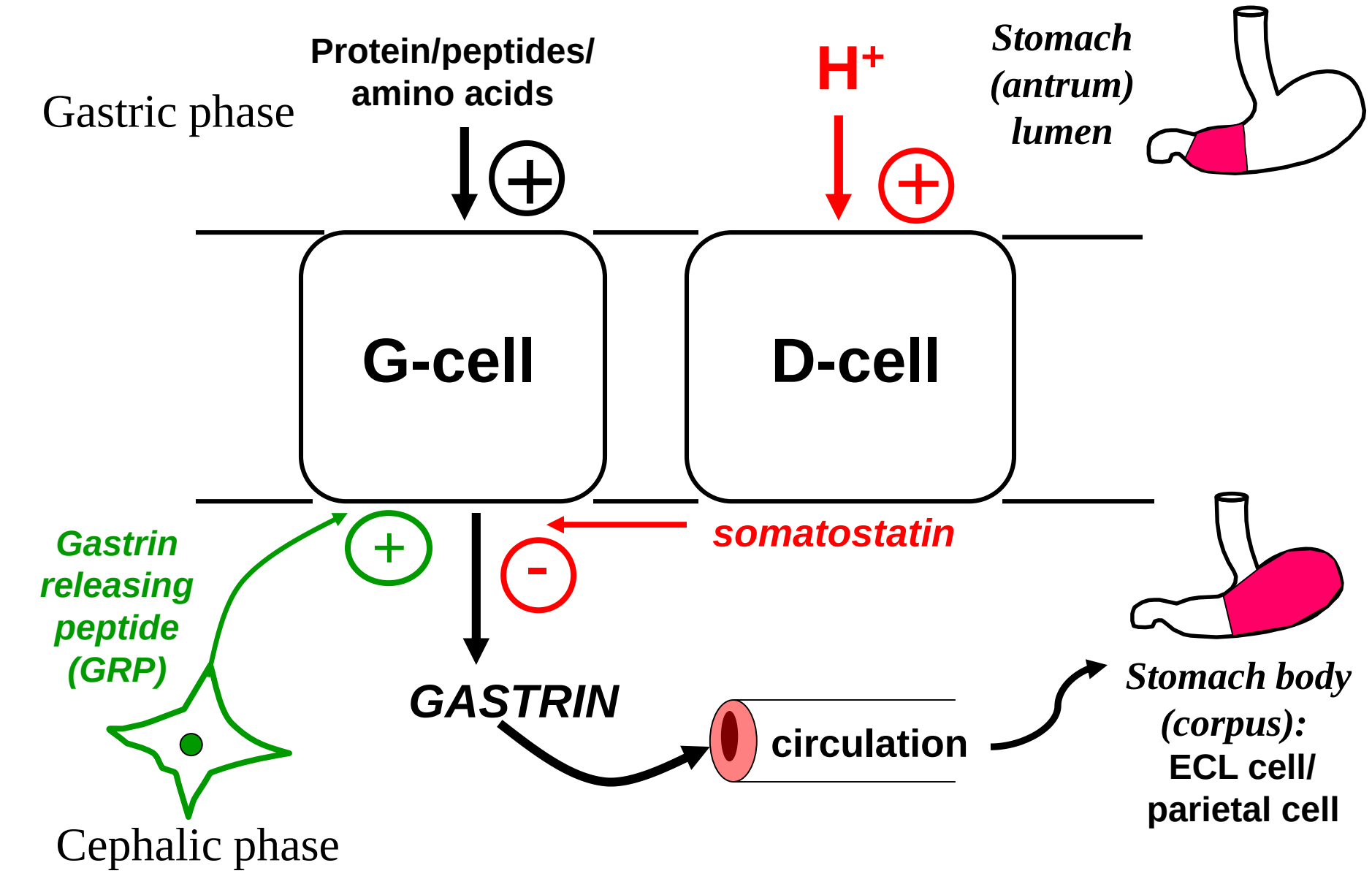
LO4

INHIBITION OF ACID SECRETION



LO4

Control of antral G-cell function



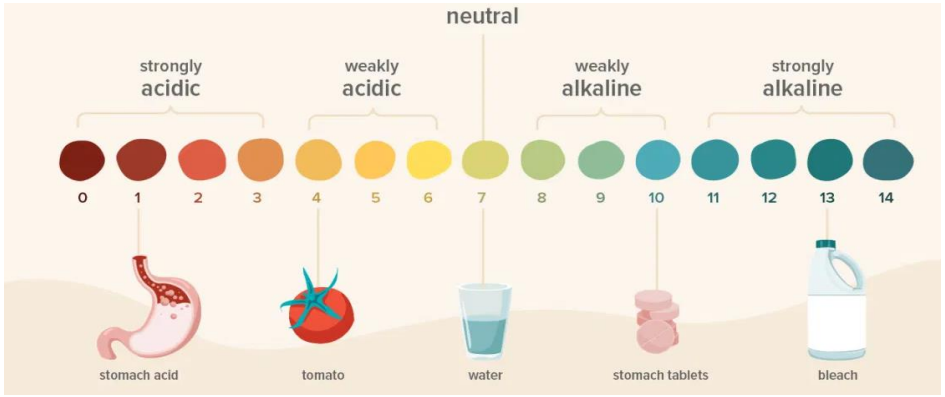
LO5

Acid inhibitory – antacids

reflux oesophagitis

"heart burn"

Peptic ulcer



Commercial Antacids Use A Variety of Chemicals

❖ **Bicarbonate** - based antacids: Alka Seltzer

$$NaHCO_3 + 1HCl \rightarrow NaCl + H_2CO_3$$
$$H_2CO_3 \rightarrow H_2O + CO_2$$

❖ **Calcium** - based antacids: Tums, Rennies

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2CO_3$$

❖ **Aluminum** - based antacids: Maalox, Mylanta

$$Al(OH)_3 + 3HCl \rightarrow AlCl_3 + 3H_2O$$

❖ **Magnesium** - based antacids: Mylanta, Milk of Magnesia

$$Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$$

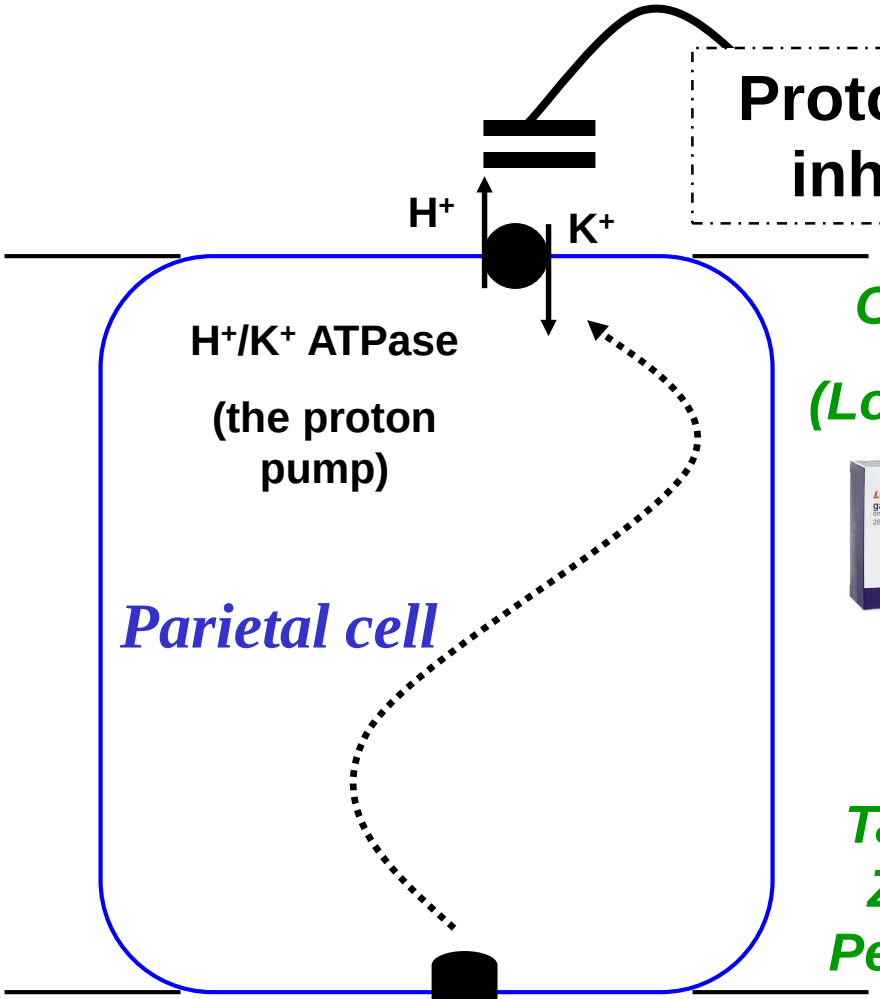
LO5

Molecular targeted acid inhibitory therapy

reflux oesophagitis

"heart burn"

Peptic ulcer



Proton pump inhibitors

Omeprazole

(Losec/Nexium)

Tagamet, Zantac, Pepcid AC

H_2 receptor antagonists

LO5

Helicobacter pylori

A class 1 biological carcinogen (IARC, 1994)

Infection in the antrum, associated with;

↓ **Somatostatin secretion**

↑ **Gastrin (hypergastrinaemia)**

↑ **acid secretion**

duodenal and peptic ulcer disease

Infection in antrum and corpus, associated with

↑ **Gastrin (hypergastrinaemia)**

↓ **acid secretion**

atrophic gastritis, gastric cancer

LO5

The Nobel Prize in Physiology or Medicine 2005

"for their discovery of the bacterium *Helicobacter pylori* and its role in gastritis and peptic ulcer disease"

3 October 2005

Barry J. Marshall

J. Robin Warren

http://nobelprize.org/medicine/laureates/2005/press.html

UNIVERSITY OF LIVERPOOL

Thank you for your attention.

bjcampbl@liv.ac.uk

http://pcwww.liv.ac.uk/~bjcampbl/Indigestion%201.htm