Unit V – Problem 4 – Physiology: GI Regulatory Substances and Gastric Secretions

- GI regulatory substances:

Regulatory substance	Source	Action	Regulation	Notes
Cholecystokinin	I-cells (in duodenum and jejunum)	• ↑ pancreatic secretion • ↑gallbladder contraction • ↓ Gastric emptying • ↑ sphincter of Oddi relaxation	• ↑ by fatty acids and amino acids	• CCK acts on neural nuscarinic pathways to cause pancreatic secretion
Gastrin	G-cells (in antrum of stomach)	• ↑ gastric H secretion • ↑ growth of gastric mucosa • ↑ gastric motility	• ↑ by stomach distention, alkalinization, amino acids, peptides and vagal stimulation • ↓ by stomach pH < 1.5	• ↑↑ in Zollinger-Ellison syndrome. • ↑ by chronic PPI use • Phenylalanine and tryptophan are potent stimulators
Glucose-dependent insulinotropic peptide	K-cells (in duodenum and jejunum)	• Exocrine: ↓ gastric H secretion • Endocrine: ↑ insulin release	• ↑ by fatty acids, amino acids and oral glucose	• Also known as gastric inhibitory peptide (GIP). • An oral glucose load is used more rapidly than the equivalent given by IV due to GIP secretion
Motilin	Small intestine	• Produces migrating motor complexes (MMCs)	• ↑ in fasting state	• Motilin receptor agonists (e.g. erythromycin) are used to stimulate intestinal peristalsis
Secretin	S-cells (in duodenum)	• ↑ pancreatic HCO_3 secretion • ↓ gastric acid secretion • ↑ bile secretion	• ↑ by acid and fatty acids in the lumen of the duodenum	• Inhibitory hormone • anti-growth hormone effects (inhibits digestion and absorption of substances needed for growth)
Nitric oxide		• ↑ smooth muscle relaxation, including lower esophageal sphincter (LES)		• Loss of NO secretion is implicated in ↑ LES tone of achalasia
Vasoactive intestinal polypeptide (VIP)	Parasympathetic ganglia in sphincters, gallbladder and small intestine	• ↑ intestinal water and electrolyte secretion. • ↑ relaxation of intestinal smooth muscle and sphincters	• ↑ by distention and vagal stimulation. • ↓ by adrenergic input	

- GI secretory products:

Product	Source	Action	Regulation	Notes
Intrinsic factor	Parietal cells (stomach)	• Vitamin B12-binding protein (needed for B12 uptake in terminal ileum)		• Autoimmune destruction of parietal cells → chronic gastritis and pernicious anemia
Gastric acid	Parietal cells (stomach)	• ↓ stomach pH	• ↑ by histamine, Ach and gastrin • ↓ by somatostatin, GIP, prostaglandin and secretin	• Gastrinoma: gastrin-secreting tumor that causes high levels of acid secretion and ulcers refractor to medical therapy
Pepsin	Chief cells (stomach)	• Protein digestion	• ↑ vagal stimulation and local acid	• Inactive pepsinogen → pepsin by H^+
HCO_3^-	• Mucosal cells (stomach, duodenum, salivary glands & pancreas) • Brunner glands (duodenum)	• Neutralizes acid	• ↑ by pancreatic and biliary secretion with secretin	• HCO_3^- is trapped in mucus that covers the gastric epithelium