***M.Sc. Zoology : Syllabus (CBCS)***

**SEMESTER III**

**PAPER-7**

**ANIMAL PHYSIOLOGY**

**UNIT-I: NUTRITION - Role of gastrointestinal hormones in digestion.**

**II M.Sc.ZOOLOGY**

**Paper: ANIMAL PHYSIOLOGY-code: MZO31**

Role of gastrointestinal hormones in digestion.

**Gastrointestinal hormone**

Reference from The free encyclopedia

 The gastrointestinal hormones (or gut hormones) constitute a group of [hormones](https://en.wikipedia.org/wiki/Hormone) secreted by [enteroendocrine cells](https://en.wikipedia.org/wiki/Enteroendocrine_cell) in the [stomach](https://en.wikipedia.org/wiki/Stomach), [pancreas](https://en.wikipedia.org/wiki/Pancreas), and [small intestine](https://en.wikipedia.org/wiki/Small_intestine) that control various functions of the digestive organs. Later studies showed that most of the gut peptides, such as [secretin](https://en.wikipedia.org/wiki/Secretin), [cholecystokinin](https://en.wikipedia.org/wiki/Cholecystokinin) or [substance P](https://en.wikipedia.org/wiki/Substance_P), were found to play a role of [neurotransmitters](https://en.wikipedia.org/wiki/Neurotransmitter) and [neuromodulators](https://en.wikipedia.org/wiki/Neuromodulator) in the central and peripheral nervous systems.

 Enteroendocrine cells do not form glands but are spread throughout the digestive tract. They exert their autocrine and paracrine actions that integrate gastrointestinal function.

**Types**

The gastrointestinal hormone can be divided into three main groups based upon their [chemical structure](https://en.wikipedia.org/wiki/Chemical_structure).

* [*Gastrin–cholecystokinin family*](https://en.wikipedia.org/wiki/Gastrin_family): [gastrin](https://en.wikipedia.org/wiki/Gastrin) and [cholecystokinin](https://en.wikipedia.org/wiki/Cholecystokinin)
* [*Secretin family*](https://en.wikipedia.org/wiki/Secretin_family): [secretin](https://en.wikipedia.org/wiki/Secretin), [glucagon](https://en.wikipedia.org/wiki/Glucagon), [vasoactive intestinal peptide](https://en.wikipedia.org/wiki/Vasoactive_intestinal_peptide) and [gastric inhibitory peptide](https://en.wikipedia.org/wiki/Gastric_inhibitory_peptide)
* [*Somatostatin family*](https://en.wikipedia.org/wiki/Somatostatin_family)
* [*Motilin family*](https://en.wikipedia.org/wiki/Motilin_family)
* [Substance P](https://en.wikipedia.org/wiki/Substance_P).

[**Ghrelin**](https://en.wikipedia.org/wiki/Ghrelin) is a peptide hormone released from the stomach and liver and is often referred to as the "hunger hormone" since high levels of it are found in individuals that are fasting. Ghrelin agonistic treatments can be used to treat illnesses such as anorexia and loss of appetites in cancer patients. Ghrelin treatments for obesity are still under intense scrutiny and no conclusive evidence has been reached. This hormone stimulates growth hormone release. [**Amylin**](https://en.wikipedia.org/wiki/Amylin) controls glucose homeostasis and gastric motility

[**Glucose-dependent insulinotropic polypeptide**](https://en.wikipedia.org/wiki/Glucose-dependent_insulinotropic_polypeptide) possesses an acute influence on food intake through its effects on adipocytes

[**Oxyntomodulin**](https://en.wikipedia.org/wiki/Oxyntomodulin) plays a role in controlling acid secretion and satiation

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| Characteristics of prominent forms of principal gut regulatory peptides[[3]](https://en.wikipedia.org/wiki/Gastrointestinal_hormone#cite_note-Tietz-3):1719  |
| **Hormone or peptide** | **Molecular weight (Da)** | **Number of amino acids** | **Main gut localization** | **Principal physiologic actions**  |
| [**Gastrin family**](https://en.wikipedia.org/wiki/Gastrin_family) |  |  |  |  |
| [Cholecystokinin](https://en.wikipedia.org/wiki/Cholecystokinin) | 3918 | 33 (also 385, 59) | Duodenum and jejunum, Enteric nerves | Stimulates gallbladder contraction and intestinal motility; stimulates secretion of pancreatic enzymes, insulin, glucagon, and pancreatic polypeptides; has a role in indicating satiety; the C-terminal 8 amino acid peptide cholecystokinin (CCK)-8 retains full activity  |
| [Little gastrin](https://en.wikipedia.org/wiki/Little_gastrin) | 2098 | 17 | Both forms of gastrin are found in the gastric antrum and duodenum | Gastrins stimulate the secretion of gastric acid, pepsinogen, intrinsic factor, and secretin; stimulate intestinal mucosal growth; increase gastric and intestinal motility  |
| [Big gastrin](https://en.wikipedia.org/wiki/Big_gastrin) | 3839 | 34 |  |  |
| [**Secretin-glucagon family**](https://en.wikipedia.org/wiki/Secretin_family) |  |  |  |  |  |  |
| [Secretin](https://en.wikipedia.org/wiki/Secretin) | 3056 | 27 | Duodenum and jejunum | Stimulates pancreatic secretion of HCO3, enzymes and insulin; reduces gastric and duodenal motility, inhibits gastrin release and gastric acid secretion  |  |  |
| [Vasoactive intestinal polypeptide](https://en.wikipedia.org/wiki/Vasoactive_intestinal_polypeptide) (VIP) | 3326 | 28 | Enteric nerves | Relaxes smooth muscle of gut, blood vessels, and genitourinary system; increases water and electrolyte secretion from pancreas and gut; releases hormones from pancreas, gut, and hypothalamus  |  |  |
| [Glucose-dependent insulinotropic](https://en.wikipedia.org/wiki/Gastric_inhibitory_polypeptide) | 4976 | 42 | Duodenum and jejunum | Stimulates insulin release; reduces gastric and intestinal motility; increases fluid and electrolyte secretion from small intestine  |  |  |

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| Brief Description of Some GI Regulatory Peptides[[3]](https://en.wikipedia.org/wiki/Gastrointestinal_hormone#cite_note-Tietz-3):1720  |
| **Hormone or peptide** | **Major tissue locations in the gut** | **Principal known actions**  |
| [Bombesin](https://en.wikipedia.org/wiki/Bombesin) | Throughout the gut and pancreas | Stimulates release of cholecystokinin (CCK) and gastrin  |
| [Calcitonin gene-related peptide](https://en.wikipedia.org/wiki/Calcitonin_gene-related_peptide) | Enteric nerves | Unclear  |
| [Chromogranin A](https://en.wikipedia.org/wiki/Chromogranin_A) | Neuroendocrine cells | Secretory protein  |
| [Enkephalins](https://en.wikipedia.org/wiki/Enkephalins) | Stomach, duodenum | Opiate-like actions  |
| [Enteroglucagon](https://en.wikipedia.org/wiki/Enteroglucagon) | Small intestine, pancreas | Inhibits insulin secretion  |
| [Galanin](https://en.wikipedia.org/wiki/Galanin) | Enteric nerves |  |
| [Ghrelin](https://en.wikipedia.org/wiki/Ghrelin) | Stomach | Stimulates appetite, increases gastric emptying  |
| [Glucagon-like peptide 1](https://en.wikipedia.org/wiki/Glucagon-like_peptide_1) | Pancreas, ileum | Increases insulin secretion  |
| [Glucagon-like peptide 2](https://en.wikipedia.org/wiki/Glucagon-like_peptide-2) | Ileum, colon | Enterocyte-specific growth hormone  |
| [Growth factors](https://en.wikipedia.org/wiki/Growth_factors) | Throughout the gut | Cell proliferation and differentiation  |
| [Growth hormone-releasing factor](https://en.wikipedia.org/wiki/Growth_hormone-releasing_factor) | Small intestine | Unclear  |
| [Leptin](https://en.wikipedia.org/wiki/Leptin) | Stomach | Appetite control  |
| [Motilin](https://en.wikipedia.org/wiki/Motilin) | Throughout the gut | Increases gastric emptying and small bowel motility  |
| [Neuropeptide Y](https://en.wikipedia.org/wiki/Neuropeptide_Y) | Enteric nerves | Regulation of intestinal blood flow  |
| [Neurotensin](https://en.wikipedia.org/wiki/Neurotensin) | Ileum | Affects gut motility; increases jejunal and ileal fluid secretion  |
| [Pancreatic polypeptide](https://en.wikipedia.org/wiki/Pancreatic_polypeptide) | Pancreas | Inhibits pancreatic and biliary secretion  |
| [Peptide YY](https://en.wikipedia.org/wiki/Peptide_YY) | Colon | Inhibits food intake  |
| [Somatostatin](https://en.wikipedia.org/wiki/Somatostatin) | Stomach, pancreas | Inhibits secretion and action of many hormones  |
| [Substance P](https://en.wikipedia.org/wiki/Substance_P) | Enteric nerves | Unclear  |
| [Trefoil peptides](https://en.wikipedia.org/wiki/Trefoil_domain) | Stomach, intestine | Mucosal protection and repair  |

**Notes and references**

 *["Enteric Endocrine System"](http://www.vivo.colostate.edu/hbooks/pathphys/digestion/basics/gi_endocrine.html). www.vivo.colostate.edu. Retrieved 2016-09-16.*

  Vella A and Drucker DJ (2011)Chapter 39 Gastrointestinal Hormones and Gut Endocrine Tumors, pp 1697-1707. In Williams Textbook of Endocrinology (2011, 12th edition)

 *Burtis CA, Ashwood ER, Bruns DE (2012-10-14).* [*Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 5th edition*](https://books.google.com/?id=BBLRUI4aHhkC&pg=PA1719&dq=Brief+Description+of+Some+GI+Regulatory+Peptides#v=onepage&q=Brief%20Description%20of%20Some%20GI%20Regulatory%20Peptides&f=false)*. Elsevier Saunders.* [*ISBN*](https://en.wikipedia.org/wiki/ISBN_%28identifier%29)[*978-1-4160-6164-9*](https://en.wikipedia.org/wiki/Special%3ABookSources/978-1-4160-6164-9)*.*

### Gastrointestinal peptides

 GI peptides are signal molecules that are released into the blood by the GI cells themselves. They act on a variety of tissues including the brain, digestive accessory organs, and the GI tract. The effects range from excitatory or inhibitory effects on motility and secretion to feelings of satiety or hunger when acting on the brain. These hormones fall into three major categories, the [gastrin](https://en.wikipedia.org/wiki/Gastrin) and [secretin](https://en.wikipedia.org/wiki/Secretin) families, with the third composed of all the other hormones unlike those in the other two families. Further information on the GI peptides is summarized in the table below.

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| **General GI peptide information**  |
|  | **Secreted by**  | **Target**  | **Effects on endocrine secretion**  | **Effects on exocrine secretion**  | **Effects on motility**  | **Other effects**  | **Stimulus for release**  |
| [Gastrin](https://en.wikipedia.org/wiki/Gastrin)  | G Cells in stomach  | ECL cells; parietal cells  | None  | Increases acid secretion, increases mucus growth  | Stimulates gastric contraction  | None  | Peptides and amino acids in lumen; gastrin releasing peptide and ACh in nervous reflexes  |
| [Cholecystokinin](https://en.wikipedia.org/wiki/Cholecystokinin) (CCK)  | Endocrine I cells of the small intestine; neurons of the brain and gut  | Gallbladder, pancreas, gastric smooth muscle  | None  | Stimulates pancreatic enzyme and HCO3- secretion  | Stimulates gallbladder contraction; inhibits stomach emptying  | Satiety  | Fatty acids and some amino acids  |
| [Secretin](https://en.wikipedia.org/wiki/Secretin)  | Endocrine S cells of the small intestine  | Pancreas, stomach  | None  | Stimulates pancreatic and hepatic HCO3- secretion; inhibits acid secretion; pancreatic growth  | Stimulates gallbladder contraction; Inhibits stomach emptying  | None  | Acid in small intestine  |
| [Gastric inhibitory Peptide](https://en.wikipedia.org/wiki/Gastric_inhibitory_polypeptide)  | Endocrine K cells of the small intestine  | Beta cells of the pancreas  | Stimulates pancreatic insulin release  | Inhibits acid secretion  | None  | Satiety and lipid metabolism  | Glucose, fatty acid, and amino acids in small intestine  |
| [Motilin](https://en.wikipedia.org/wiki/Motilin)  | Endocrine M cells in small intestine  | Smooth muscle of stomach and duodenum  | None  | None  | Stimulates migrating motor complex  | Action in brain, stimulates migratory motor complex  | Fasting: cyclic release every 1.5–2 hours by neural stimulus  |
| [Glucagon-like peptide-1](https://en.wikipedia.org/wiki/Glucagon-like_peptide-1)  | Endocrine cells in small intestine  | Endocrine pancreas  | Stimulates insulin release; inhibits glucagon release  | Possibly inhibits acid secretion  | Slows gastric emptying  | Satiety; [various CNS functions](https://en.wikipedia.org/wiki/Glucagon-like_peptide-1#CNS_functions)  | Mixed meals of fats and carbohydrates  |

