



GIT Module <u>LGIS PHYSIOLOGY</u>) 2nd Year MBBS (2025) Introduction To GIT, Electrical Activity In GIT, Enteric Nervous System

Dr. Ali Zain PGT physiology

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Motto

Vision; The Dream/Tomorrow



- To impart evidence based research oriented medical education
- To provide best possible patient care
- To inculcate the values of mutual respect and ethical practice of medicine



BLOOM'S TAXONOMY OF THE COGNITIVE DOMAIN



General Format for Large Group Interactive Session of Physiology:

S. No.	Headings	Domains/Type of Integration	Aproximate %
1.	Title	 <u>Saliva & Mastication. Stages of Swallowing. Cli</u> <u>Swallowing & esophagus. Achalasia & Vomitin</u> 	inical Disorders of g
2.	Learning Objectives	Mentioned on the separate slide	Mentioned on the separate slide
3.	Physiologic Anatomy (Histology)	 Brain Storming/ Horizontal Integration Interactive 	15%
4.	Core Concepts of the Topic	Core concepts of Physiology	60%
5.	Concept explained through Animations	Core Concepts of Physiology	10%
6.	Topic with key	Interactive	5%
7.	Research article relevant to the topic with reference	 Promotion of research culture Use of Digital Library Critical Thinking Self-directed Learning 	5%
8.	PM&DC Code of Ethics/Professionalism/Communicati on Skills with reference	 Professional Ethics Self-directed Learning Interactive 	5%



Learning Objectives

1	 To enlist the functions of Gastrointestinal tract 	C1
2	 To discuss the generation of electrical activity in Gastrointestinal smooth muscles 	C1 & C2
3	• To summarize the neural control of GIT	C2
4	 Apply knowledge of GIT physiology to real-life scenarios, emphasizing the importance of maintaining digestive health. 	C3
5	 Understand the Gastrointestinal reflexes 	C2



Horizontal integration (Anatomy)



Physiological Anatomy Of GIT

> Core Concept & Horizontal Integration



Introduction To GIT, Electrical Activity In GIT, Enteric Nervous

System

Physiologic Anatomy (Histology) of GI Wall: (Horizontal Integration with Anatomy)







Functional Anatomy Of Unitary Smooth Muscles

> Core Concept





- The smooth muscle of the GIT is excited by almost continual slow, intrinsic electrical activity
- This activity has two basic types of electrical waves:

1. Slow waves 2. Spike Potential



Core

Concept



Characteristics of Slow Waves:

(Core Concepts)

They are not action potentials

Slow, undulating changes in resting membrane potential

Intensity usually varies between 5 and 15 millivolts

Caused by complex interactions among the smooth muscle cells and specialized cells, called the interstitial cells of Cajal

Cells of Cajal act as electrical pacemakers for smooth muscle cells

Core Concept

14



Concept about Interstitial Cells of Cajal as Pacemakers: (Core Concepts)

Interstitial cells of Cajal undergo cyclic changes in membrane potential due to unique ion channels that periodically open and produce inward (pacemaker) currents that may generate slow wave activity

Spontaneous activation Interstitial of pacemaker current cell network in pacemaker region (MY-ICC) Electrotonic conduction of slow Smooth waves via gap junctions muscle cells Intramuscular ICC Depolarization and activation of (IM-ICC) L-type Ca⁺ channels in SMC Neural input to IM-ICC Enteric motor neuron conditions responses Ref.:Guyton, Ed.14 & Silverthorn, of smooth muscles to Core Varicose terminals slow waves Concept



Ed. 8

Generation of Spike Potentials: (Core Concepts)

- True action potentials
- Occur automatically when resting membrane potential becomes more positive than about –40 millivolts





Factors That Depolarize The Membrane: (Core Concepts) Factors That Repolarize The Membrane: (Core Concepts)

- Stretching of the muscle
- Stimulation by acetylcholine released from the endings of parasympathetic nerves
- Stimulation by several specific gastrointestinal hormones

- Effect of norepinephrine or epinephrine on the fiber membrane
- Stimulation of the sympathetic nerves that secrete mainly norepinephrine at their endings

Core Concept



III- Enteric Nervous System & Its Composition: (Horizontal Integration with Anatomy)

Enteric nervous system lies entirely within the gut wall and is composed of two subdivisions

> 1. Myenteric Plexus Or Auerbach's Plexus

- An outer plexus lying between the longitudinal and circular muscle layers
- Controls mainly the gastrointestinal movements

- 2. Submucosal or Meissenier's Plexus
- Inner plexus which lies in submucosa
- Controls mainly gastrointestinal secretion and local blood flow

Core

Concept







Neurotransmitters Secreted By Enteric Neurons: (Core Concepts)

More than 25 potential neurotransmitter substances that are released by the nerve endings of different types of enteric neurons

- Acetylcholine is stimulatory
- Nor-epinephrine is inhibitory
- Others have combined effect

- Acetylcholin
- Nor-epinephrin
- ADP (Adenosin triphosphate)
- Serotonin
- Dopamine
- Cholecystokinin
- Vaso active intestinal polypeptide
- Somatostatin
- Leu-enkephalin
- Met-enkephalin
 - Bombesin



Core

Concept

Autonomic Control Of The GIT:

(Horizontal Integration with Anatomy)

- Parasympathetic
 Stimulation increases
 the activity of the
 Enteric Nervous System
- Sympathetic
 Stimulation usually inhibits GIT activity





Afferent Sensory Nerve Fibers From the Gut:

(Horizontal Integration with Anatomy)



Many afferent sensory nerve fibers innervate the gut

- Some have cell bodies in enteric nervous system
- Some have them in dorsal root ganglia of spinal cord

These sensory nerves can be stimulated

by:

- Irritation of the gut mucosa
- Excessive gut distention
- Specific chemical substances in the gut

Core Concept & horizontal integration





Nervous Control of GIT Blood Flow

• Parasympathetic stimulation

Stomach and lower colon

blood flow and glandular secretion (not direct effect) • Sympathetic stimulation

• Direct effect on all tract

Intense vasoconstriction

Greatly reduced blood flow.

Core Concept



IV-Gastrointestinal Reflexes: (Core Concepts)

The anatomical arrangement of the enteric nervous system and its connections with the sympathetic & parasympathetic systems support three types of gastrointestinal reflexes that are essential to gastrointestinal control

1. Reflexes that are integrated entirely within the gut wall enteric nervous system

2. Reflexes from the gut to the prevertebral sympathetic ganglia and then back to the GIT

3. Reflexes from the gut to the spinal cord or brain stem and then back to the GIT

Core Concept





Superior Mesenteric Artery

> Horizontal Integration With Anatomy



Guyton & Hall physiology

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System



Area Of Supply Of Inferior Mesenteric Arteries



Portal Circulation

Horizontal Integration With Anatomy



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Brainstorming Question & Answer

A patient suffering from anemia comes to his physician complaining of frequent bouts of gastroenteritis. A blood test reveals the presence of antibodies directed against gastric parietal cells. The anemia in this patient is attributable to the hyposecretion of which gastric product?

- A.Histamine
- **B.Gastrin**
- C.Pepsinogen
- **D.Intrinsic factor**
- E.Hydrochloric acid

The correct answer is D.

Parietal cells secrete intrinsic factor, which binds to and allows the absorption of cobalamin (vitamin B₁₂), which is required in turn for the production of red blood cells. Autoimmume destruction of parietal cells can lead to anemia secondary to an inability to secrete intrinsic factor (pernicious anemia). Such patients will also have a reduction in gastric acid secretion, but this does not account for the anemia, whereas pepsinogen secretion from chief cells should be unaffected (rules out options C and E).

Vertical Integration



Suggested Research Article

Clinical Scenario:

(Vertical Integration, Critical Thinking Competency & Self-directed Learning)

A 32-year-old woman presented in Medical OPD with symptoms of recurrent abdominal pain and loose stools with 2-3 bowel movements per day. She complaint of bloating & distention over the past 6 months & it seemed to worsen with food intake, while the distention progressed throughout the day. The abdominal pain was related to defecation, with acute worsening immediately prior to defecation & significant improvement after defecation. Her family history was not significant of any organic gastrointestinal diseases

- Her weight and vital signs were normal: height 5'6", weight 120 lb, blood pressure 108/64 mm Hg, pulse 60 beats/minute, and respiratory rate 12 breaths/minute.
- General physical examination was unremarkable

Vertical Integration



Understanding Biomedical Ethics

Biomedical Ethics

Bioethics

Non-maleficence

The principle of nonmaleficence holds that there is an obligation not to inflict harm on others. It is closely associated with the maxim primum non nocere (first do no harm).









Research

NIH National Library of Medicine National Center for Biotechnology Information					
Pub	Advanced				
		Save Email			

Review > Expert Rev Gastroenterol Hepatol. 2023 Dec 14:1-16.

doi: 10.1080/17474124.2023.2295495. Online ahead of print.

Recent advances in the treatment of gastrointestinal motility disorders in children





Abstract

Introduction: Pediatric gastrointestinal motility disorders represent some of the most challenging clinical conditions with largely undefined pathogenetic pathways and therefore limited therapeutic options. Herein, we provide an overview of the recent advances in treatment options for these disorders and their clinical impact.

Areas covered: PubMed and Medline databases were searched for relevant articles related to the treatment of achalasia, esophageal atresia, gastroparesis, PIPO and constipation published between 2017 and 2022. In this article, we review and summarize recent advances in management of gastrointestinal motility disorders in children with a particular focus on emerging therapies as well as novel diagnostic modalities that help guide their application or develop new, more targeted treatments.

Expert opinion: Gastrointestinal motility disorders represent one of the most challenging conundrums in pediatric age and despite significant advances in investigative tools, the palette of treatment options remain limited. Overall, while pharmacological options have failed to bring a curative solution, recent advances in minimal invasive therapeutic and diagnostic techniques have emerged as potential keys to symptom and quality of life improvement, such as ENDOFLIP, POEM, cine-MRI, fecal microbiota transplantation.

Keywords: Achalasia; ENDOFLIP; GLASS score; PIPO; advances; cine-MRI; constipation; gastroparesis.

Longitudinal Research Curriculum



Research

Core concept

- Electrical Activity In GIT StatPearls
- https://www.ncbi.nlm.nih.gov/books/NBK459261
- Published: 2023/12/14
- Authors: Suzan A. El Sayed, Sandeep Mukherjee
- Affiliations: Oakland Un William Beaumont Sch of Med, Crei...



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Select your desired Institute. 5. A page will appear showing the resources of the institution

6. Journals and Researches will appear

7. You can find a Journal by clicking on JOURNALS AND DATABASE and enter a keyword to search for your desired journal.



References

• Books

- Guyton textbook of physiology
- Human Physiology by Dee Unglaub Silver thorn. 8TH Edition. Muscle (Chapter 12, Page 444)
- Shrewood textbook of physiology
- Ganong textbook of physiology
- Research
- https://pubmed.ncbi.nlm.nih.gov/38096022/
- Video link/youtube
- https://youtu.be/cCyTYsxECLw?si=6lcLehpq8OOvJC8K

