

The Large Intestine

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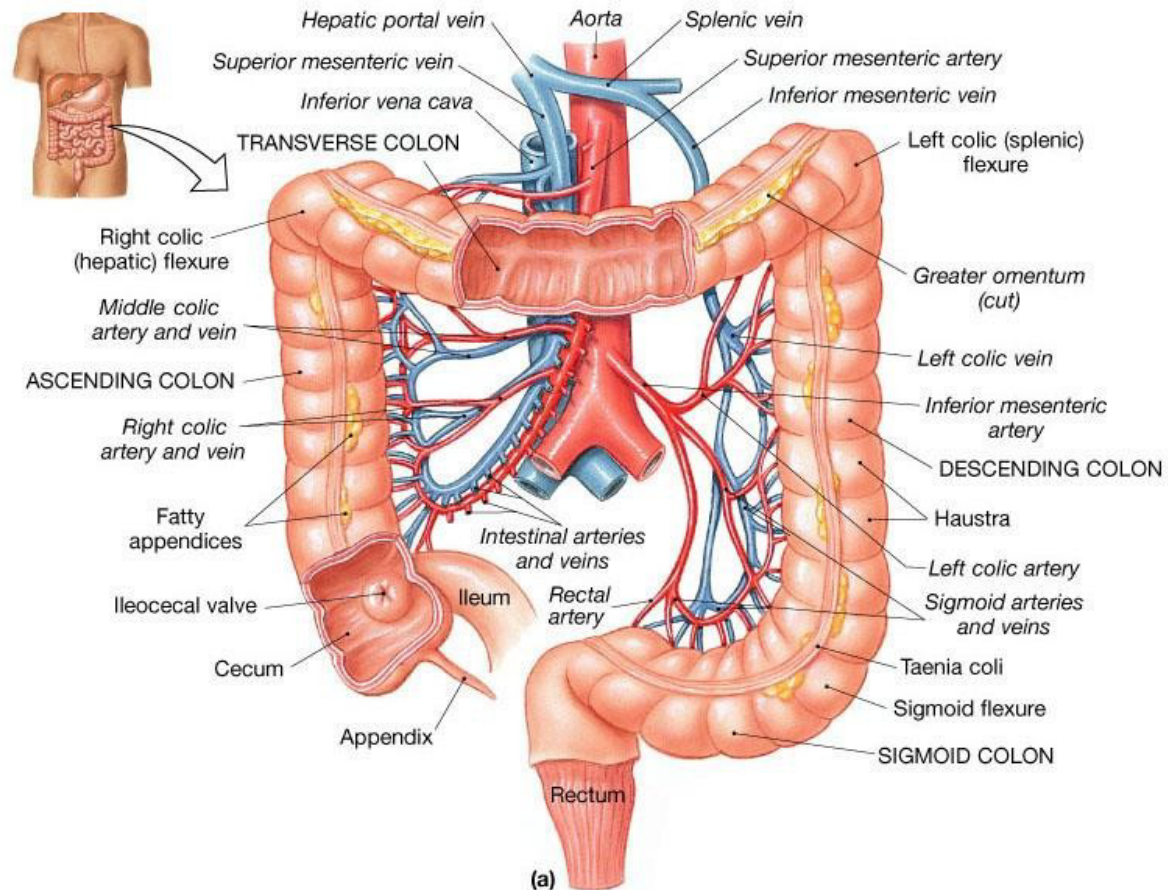
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The areas of the colon are:

- Ascending
- Transverse
- Descending
- Sigmoid
- Rectum
- Anal canal



Functions of the Large Intestine

- **Reabsorb water and compact material into feces.**
- **Absorb vitamins produced by bacteria.**
- **Store fecal matter prior to defecation.**

Secretions of the Large Intestine

Mucus Secretion:

- The mucosa of the large intestine has many crypts of Lieberkühn.
- Absence of villi.
- The epithelial cells contain almost no enzymes.
- Presence of **goblet cells** that secrete mucus (**provides an adherent medium for holding fecal matter together**).
- Stimulation of the *pelvic nerves from the spinal cord* can cause marked increase in mucus secretion. This occurs along with increase in peristaltic motility of the colon.
- During **extreme parasympathetic stimulation**, so much mucus can be secreted into the large intestine that the person has a bowel movement of **ropy mucus** as often as every 30 minutes; this mucus often contains little or no fecal material.

Absorption in the Large Intestine: Formation of Feces

- Most of the absorption in the large intestine occurs in the **proximal one half of the colon**, giving this portion the name **absorbing colon**, *whereas the distal* colon functions principally for feces storage until a propitious time for feces excretion and is therefore called the **storage colon**.

Absorption and Secretion of Electrolytes and Water

- The large intestine can absorb a maximum of **5 to 8 liters** of fluid and electrolytes each day.
- The mucosa, like that of the small intestine, has a high capability for **active** absorption of sodium, **Cl and water**.
- It **secretetes bicarbonate ions**.

Absorption and Secretion of Electrolytes and Water

- **Reabsorption in the large intestine includes:**
 - **Water**
 - **Vitamins – K, biotin, and B₅**
 - **Organic wastes – Urobilinogens and Sterobilinogens**
 - **Bile salts**
 - **Toxins**

Bacterial Action in the Colon (normal flora):

- **Colon bacilli bacteria are capable of digesting small amounts of cellulose.**
- **Vitamin K, vitamin B12, thiamine, and various gases can be formed by bacteria.**
- **The bacteria-formed vitamin K is especially important because the amount of this vitamin in the daily ingested foods is normally insufficient to maintain adequate blood coagulation.**

Bacterial Action in the Colon

(normal flora):

- **Deconjugation and decarboxylation of bile salts: Break down of bile pigments to produce stercobilinogen.**
- **Decarboxylation of some AA to produce amine and histamine. The amines are excreted in feces and are responsible for its smell.**
- **Break down of Urea by bacterial urease to ammonia. Most ammonia is absorbed and reconverted into Urea by liver.**
- **Fermentation of undigested oligo- saccharides producing gases.**

Note: chronic disruption of the normal flora in the large intestine leads to bruising and excessive bleeding.

The physiology of different colon regions

The physiology of different colon regions

1. The ascending colon is specialized for processing chyme delivered from the terminal ileum:

- When radiolabeled chyme is instilled (put gradually) into cecum, half of the instilled volume empties from ascending colon in **87 min.**
- This period is short in comparison with the transverse colon.
- The ascending colon is not the primary site of storage, mixing and removal of water.

The physiology of different colon regions

2. The transverse colon is specialized for the **storage and dehydration** of feces:
- The labeled material is retained for about 24 hrs.
 - The transverse colon is the primary site for the removal of water and electrolytes and the storage of feces.

The physiology of different colon regions

3. The descending colon is a conduit between the transverse and sigmoid colon

- Labeled feces begin to accumulate in the sigmoid colon about **24** hours after the label is instilled in the cecum
- This region has the neural program for power propulsion (mass movement) that is involved in defecation reflex.

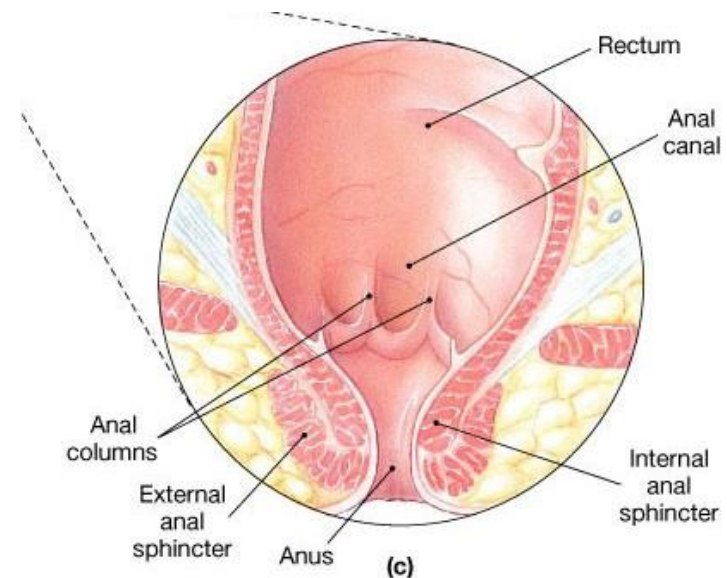
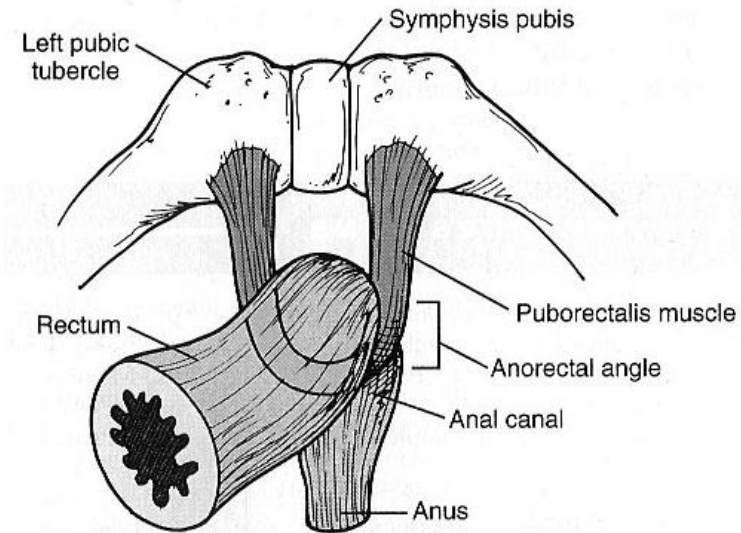
The physiology of different colon regions

4. The physiology of the rectosigmoid region, anal canal, and pelvic floor musculature maintains fecal continence (the ability to voluntarily control urinary and fecal discharge).

The sigmoid and rectum are reservoirs with a capacity of up to 500mL.

The puborectalis muscle and external anal sphincter comprise a functional unit that maintain continence.

Fibers of puborectalis join behind the anorectum and pass around it to form a U-shaped sling (**physiological valve**).



Sensory innervation and continence

- **Mechanoreceptors in the rectum detect distention and supply the ENS.**
- **The anal canal in the region of the skin is innervated by somatosensory nerves that transmit signals to CNS.**
- **This region has sensory receptors of pain, temperature and touch.**
- **Contraction of internal anal sphincter and puborectalis muscle blocks the passage of feces and maintains continence with small volumes in the rectum.**

Motility in the Large Intestine

- **The proximal half of the colon is concerned with absorption and the distal half with storage.**
- **The transit of small labeled markers through the large intestine occurs in 36-48 hrs.**

Movements of the colon:

- **Mixing movements (Haustrations)**
- **Propulsive movements (Mass Movements)**

Motility in the Large Intestine

Mixing movements (Haustrations):

- Ring-like contractions (about 2.5 cm) of the circular muscle divide the colon into pockets called haustra.
- The contracting segment and receiving segment on either side **remain in their respective state for longer periods.**
- In addition, there is uniform repetition of the haustra along the colon.
- Net forward propulsion occurs when sequential migration of haustra occurs along the length of the bowel.

Motility in the Large Intestine

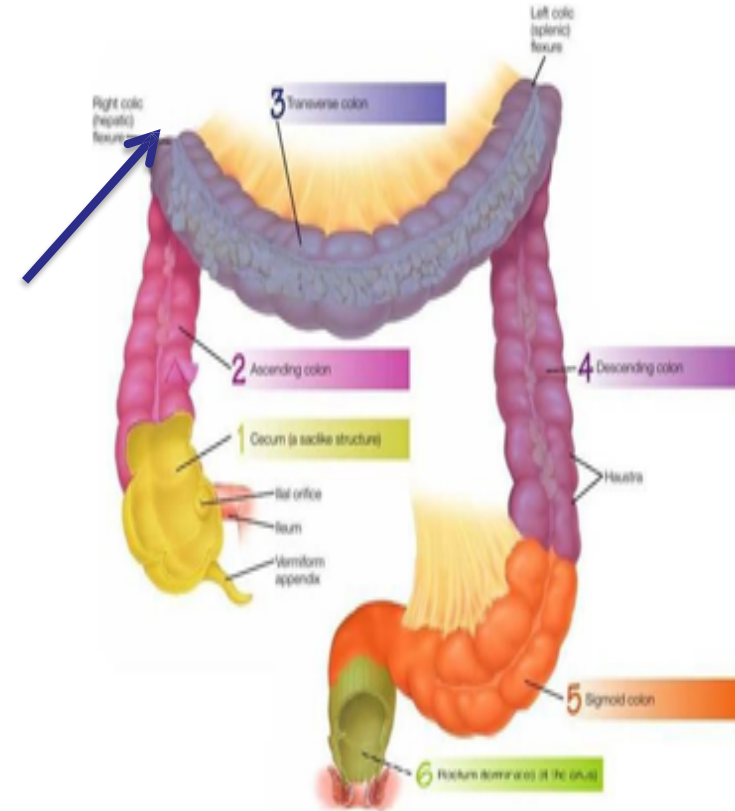
Propulsive movements (Mass Movements):

- The motor events in the transverse and descending colon.
- May be triggered by the increased delivery of ileal chyme into ascending colon following a meal (gastrocolic reflex).
- Irritants, e.g., castor oil, threatening agents such as parasites and toxins can initiate mass movement
- **Start at the middle of transverse colon and is preceded by relaxation of the circular muscle and the downstream disappearance of haustral contractions.**

Motility in the Large Intestine

Antiperistalsis

- ✓ It starts at the junction of ascending and transverse colon and traveling towards the cecum.
- ✓ It mixes contents and help water absorption.

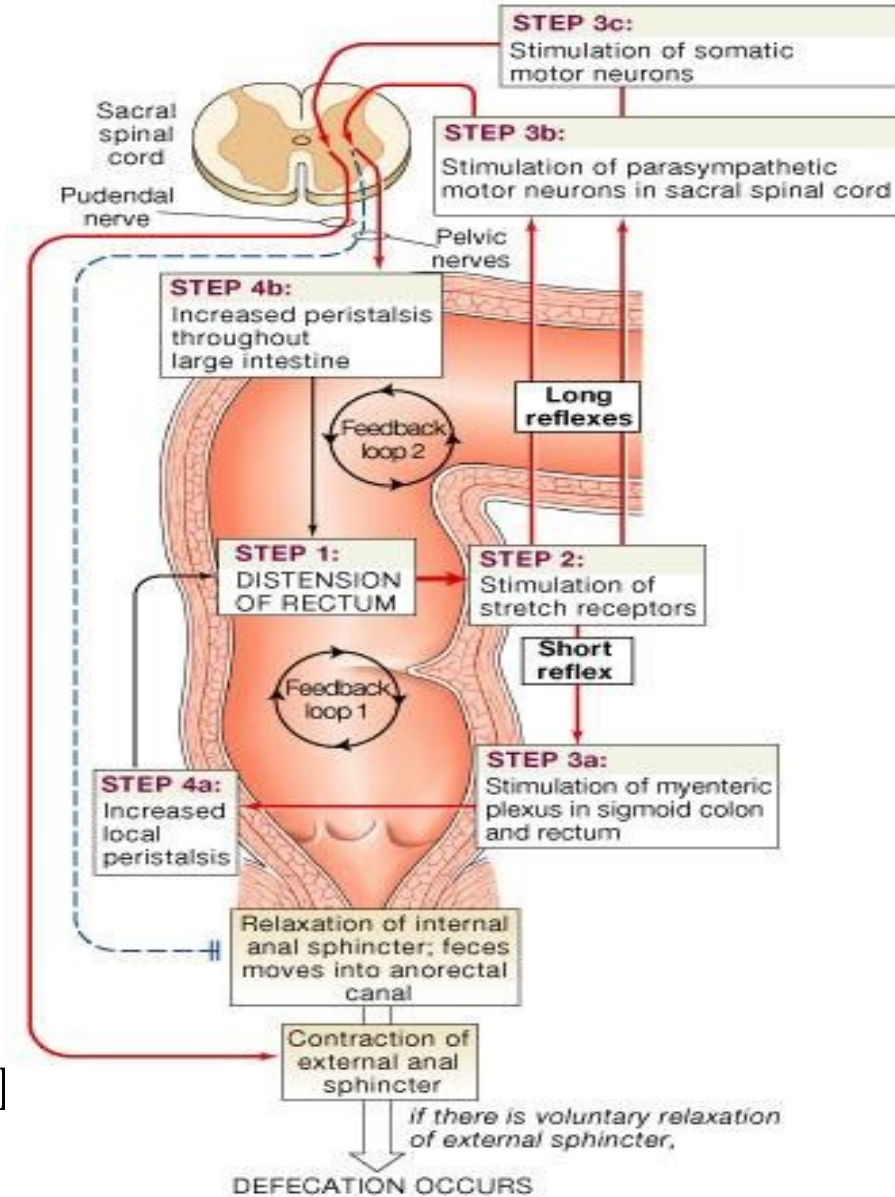


The Rectum

- **Last portion of the digestive tract.**
- **Terminates at the anal canal.**
- **Internal and external anal sphincters.**

Defecation Reflex:

1. Distension of the rectum.
2. Stimulation of the stretch receptors in the rectum.
3. **A. Short reflex:** Stimulation of myenteric plexus in sigmoid colon and rectum.
B. long reflex: stimulation of parasympathetic motor neurons in sacral spinal cord.
C. stimulation of somatic motor neurons.
4. **Result in:** increased local peristalsis. Relaxation of internal anal sphincter and contraction of external anal sphincter.

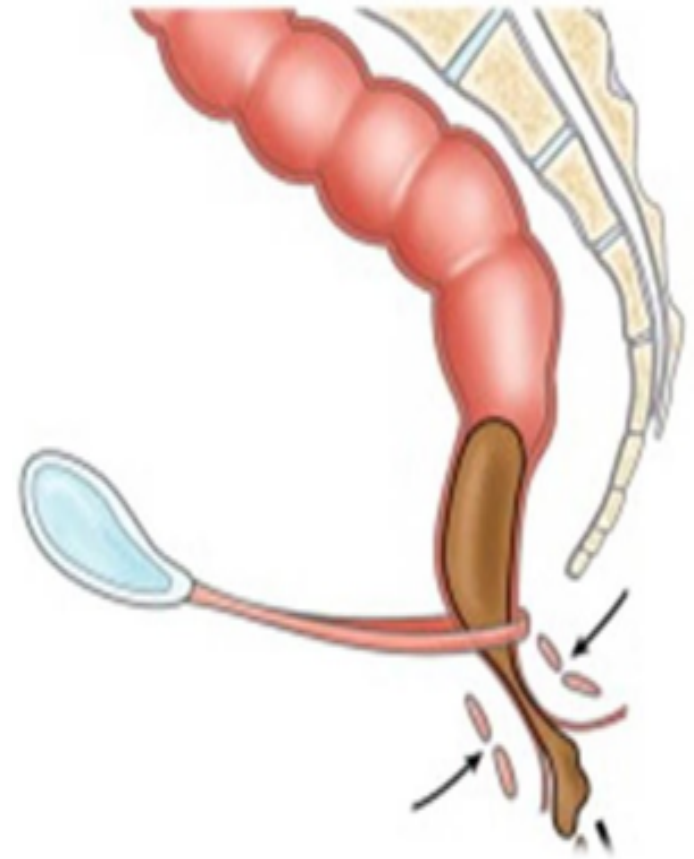


Fecal Incontinence

The spinal reflex of defecation operates without interference from higher centers.

Causes:

- In infants (physiological).
- Spinal cord lesion.
- Weakness of IAS and EAS.
- Weakness of puborectalis.
- Altered rectal or anal sensation.
- Diarrheal conditions.
- Diminished rectal capacity.



The End