

# The Gastrointestinal Tract

## Lecture 2: Anatomy & Rotations

*Developmental Dynamics of the Foregut, Midgut, and  
Hindgut*

# Section I

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## Foregut Anatomy & Rotation

Stomach, Esophagus, and Proximal Duodenum

# Anatomy of the Stomach & Duodenum

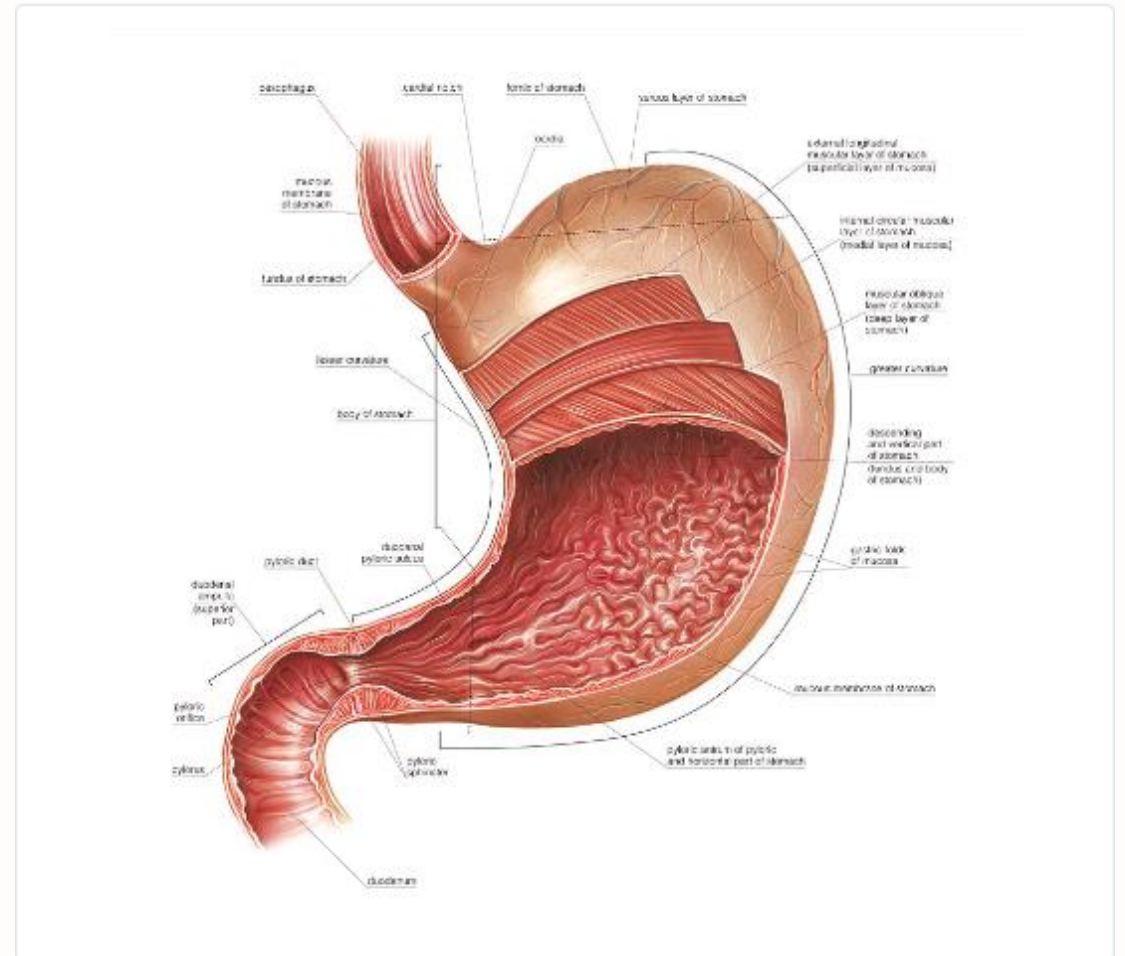
## The Upper GI Tract

The foregut derivatives comprise the distal esophagus to the second part of the duodenum.

**Stomach:** J-shaped organ with cardia, fundus, body, and pylorus.

**Duodenum:** C-shaped loop; primary site for iron absorption and enzymatic digestion.

**Blood Supply:** Primary supply from branches of the ***Celiac Trunk***.



# Stomach Embryology: 90° Rotation

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## Longitudinal Axis Rotation

The stomach rotates 90° clockwise around its longitudinal axis.

**Anterior/Posterior:** The left side becomes anterior; the right side becomes posterior.

**Nerve Effects:** The left vagus nerve becomes the *Anterior Vagal Trunk*; the right becomes the *Posterior Vagal Trunk*.

## Anteroposterior Axis Rotation

Simultaneous rotation around the AP axis changes the stomach's position:

The caudal (pyloric) part moves upward and to the right.

The cephalic (cardiac) part moves downward and to the left.

This forms the **Lesser Sac** (omental bursa) behind the stomach.

# Section II

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## Midgut Dynamics

Physiological Herniation,  $270^\circ$

Rotation, and Return

# Physiological Umbilical Herniation

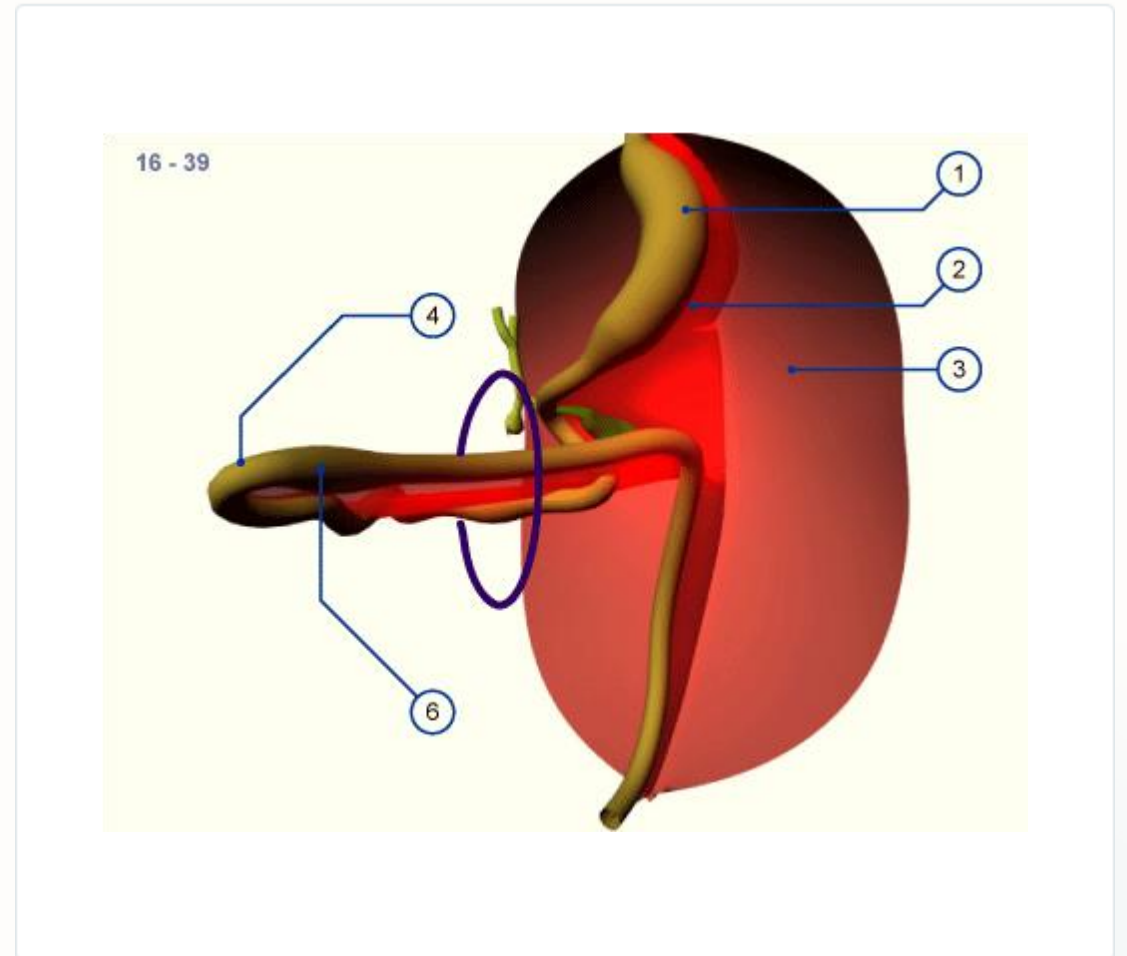
## Week 6: The Primary Loop

Rapid growth of the liver and kidneys forces the midgut loop into the extraembryonic coelom (umbilical cord).

**Cranial Limb:** Forms the jejunum and most of the ileum.

**Caudal Limb:** Forms the distal ileum, cecum, appendix, and ascending colon.

**Vitelline Duct:** Attached to the apex of the loop.



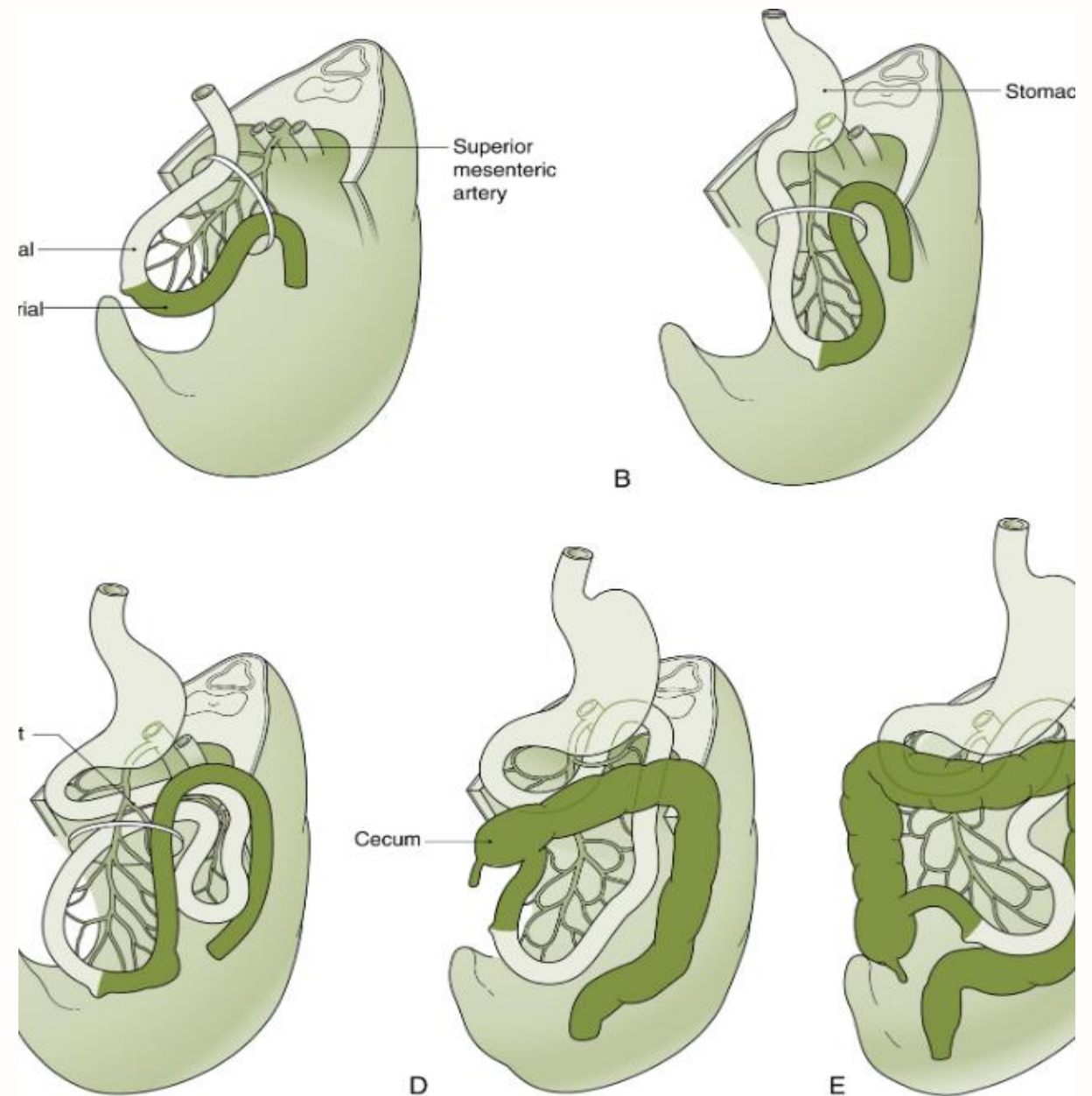
# Return & Final Rotation

## The 270° Transformation

During the 10th week, the midgut returns to the abdominal cavity while completing a 270° counterclockwise rotation around the SMA.

The jejunum returns first, settling in the upper left. The cecum returns last, initially high in the abdomen before descending to the right iliac fossa.

*This process dictates the final topography of the large and small intestines.*



# Clinical Correlates: Development



## Malrotation

Failure to complete 270° rotation can lead to **Volvulus** (twisting of gut) or Ladd's bands causing obstruction.



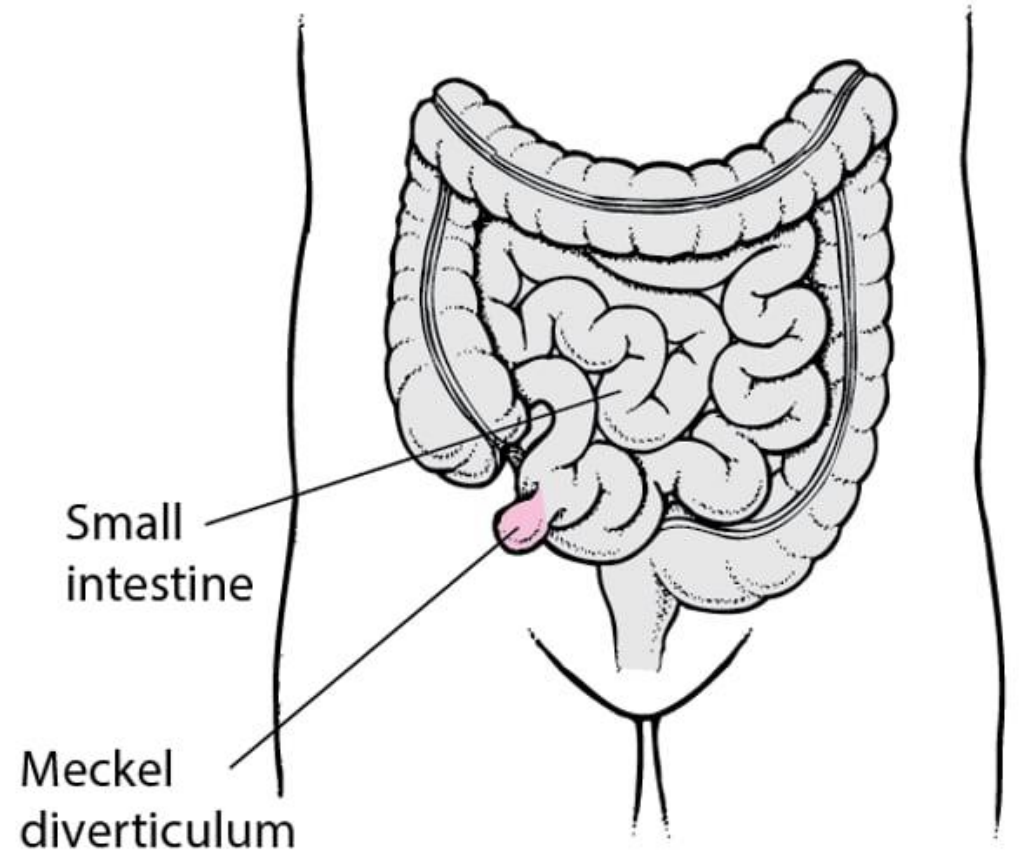
# Clinical Correlates: Development



## Meckel's Diverticulum

Persistent vitelline duct remnant.

"Rule of 2s": 2% population, 2 feet from ileocecal valve, 2 inches long.

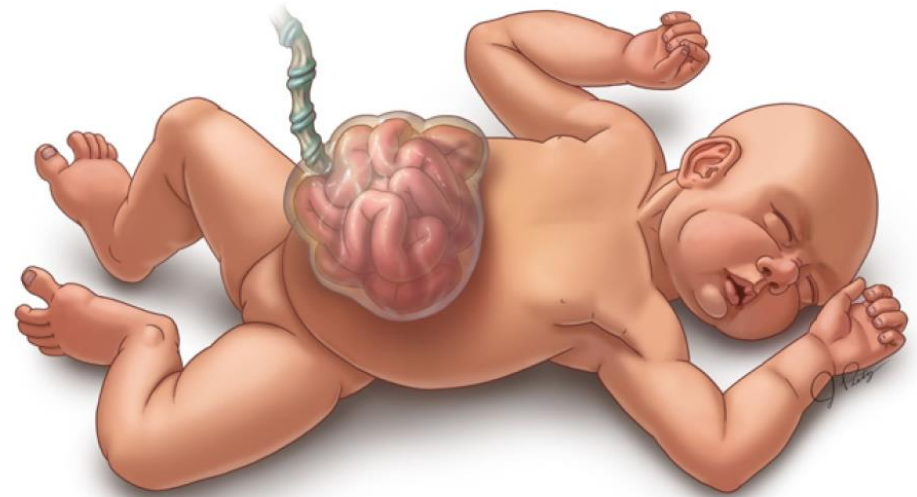


# Clinical Correlates: Development

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## **Omphalocele**

Failure of midgut return. Bowel remains herniated through the umbilicus, covered by peritoneal sac.



# Section III

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## **Hindgut & Cloacal Partitioning**

Distal Colon to the  
Anorectal Canal

# Hindgut Anatomy & The Cloaca

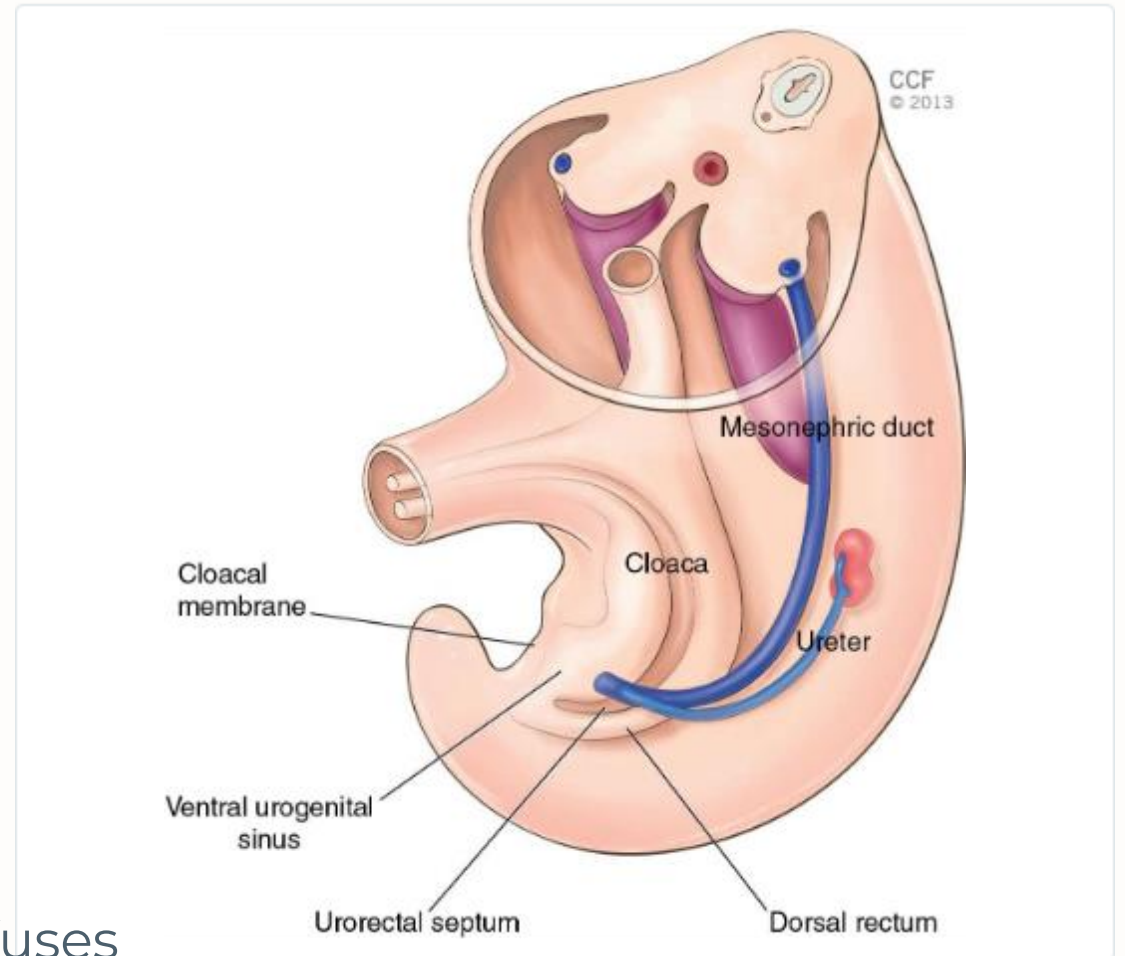
## Terminal Differentiation

The hindgut extends from the distal 1/3 of the transverse colon to the superior anal canal.

**Cloaca:** The common chamber for the hindgut and urogenital tract.

**Partitioning:** The *Urorectal Septum* divides the cloaca into the urogenital sinus and the anorectal canal.

**Perineal Body:** The point where the septum fuses with the cloacal membrane.



# Summary of Gut Derivatives

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Region	Artery	Rotation	Derivatives
<b>Foregut</b>	Celiac Trunk	90° Clockwise	Stomach, Proximal Duodenum, Liver, Pancreas
<b>Midgut</b>	SMA	270° Counter-CW	Distal Duodenum to Proximal 2/3 Transverse Colon
<b>Hindgut</b>	IMA	Minimal	Distal 1/3 Transverse Colon to Superior Anal Canal