GI EMBRYOLOGY 2

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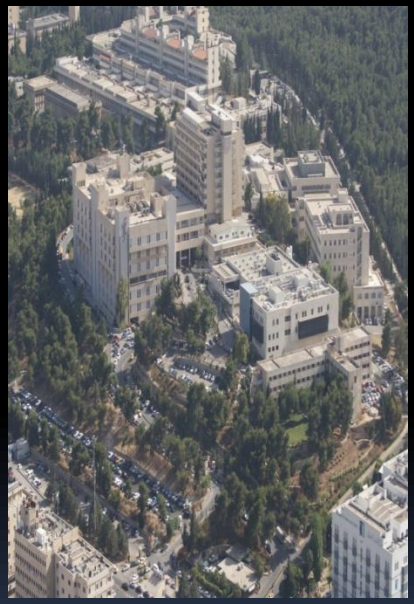


كلية الطب

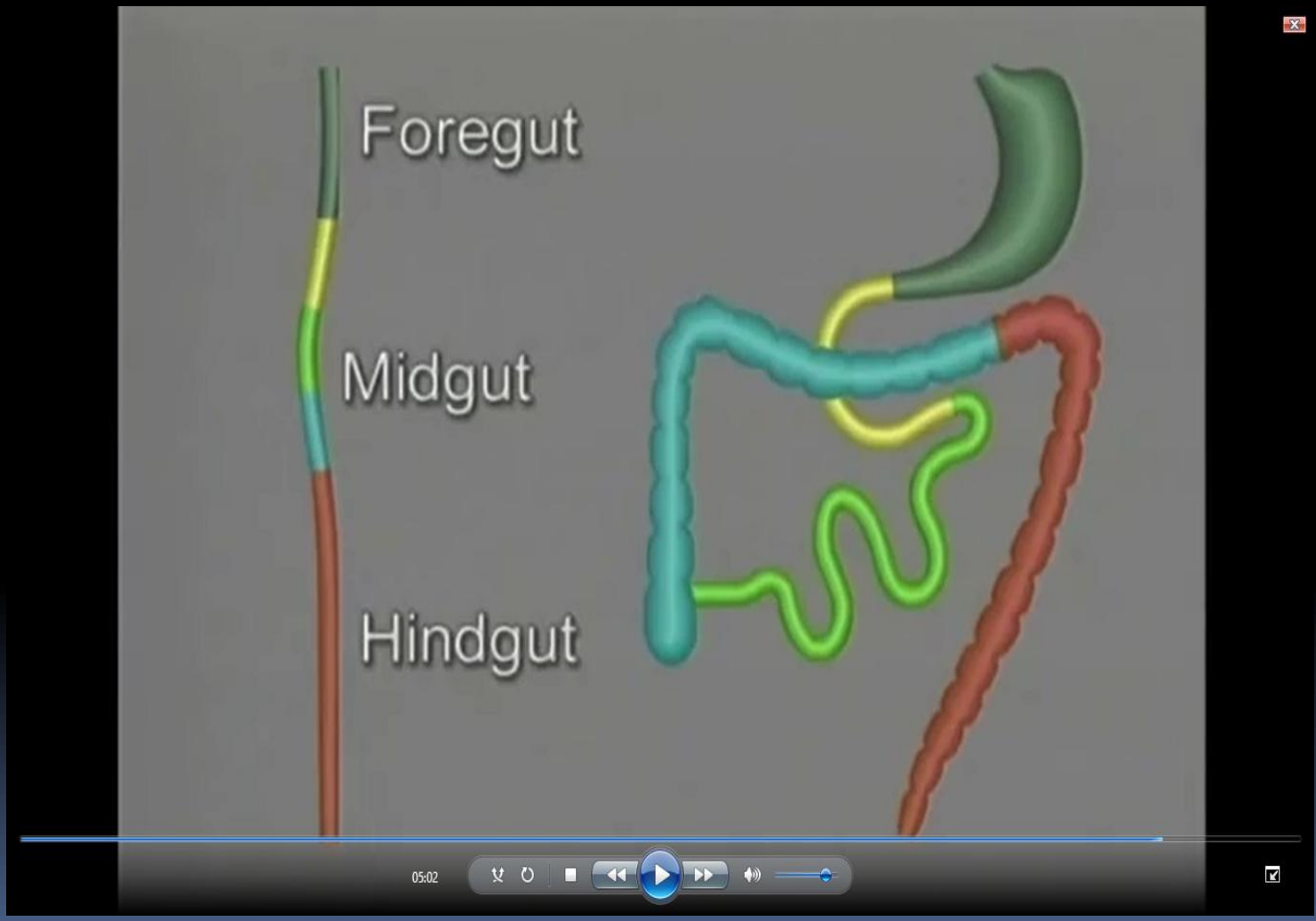
Faculty of Medicine

Outline

Clinical

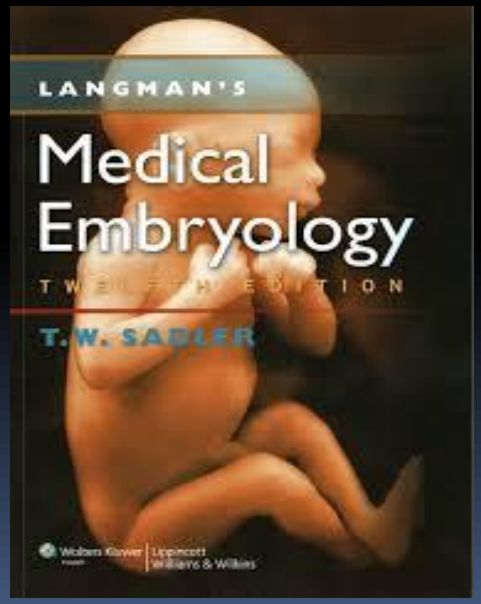
- Lecture one :
  - Gut formation
  - Foregut:
    - esophagus, stomach, Duodenum
    - Liver , gall bladder and pancreas
    - Spleen
- Lecture Two (next week):
  - Mid gut : duodenum . Jejuno-ileum, colon
  - Hind gut : distal transverse colon – anal canal

GI embryology



References

- Lecture slides
- Langman medical embryology
  - Chap 15



Case 1

vomiting

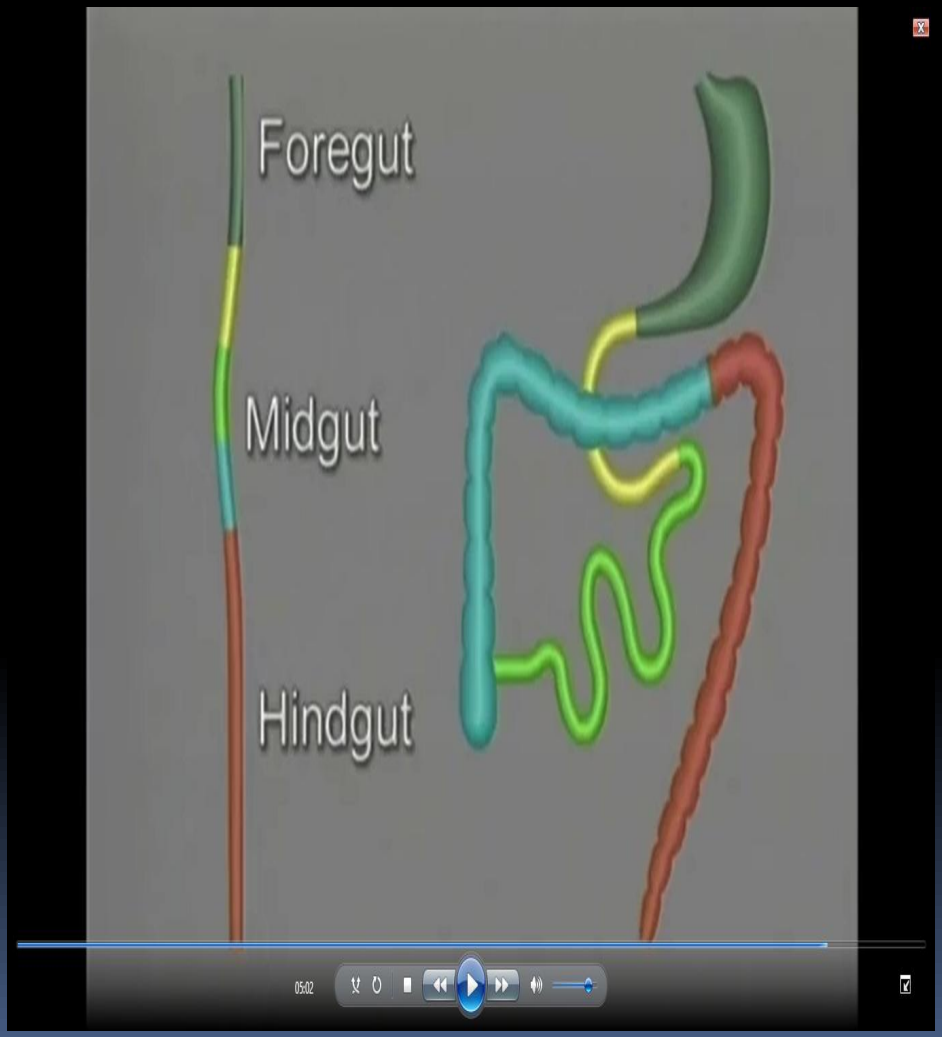
malrotation

Normal

MID GUT

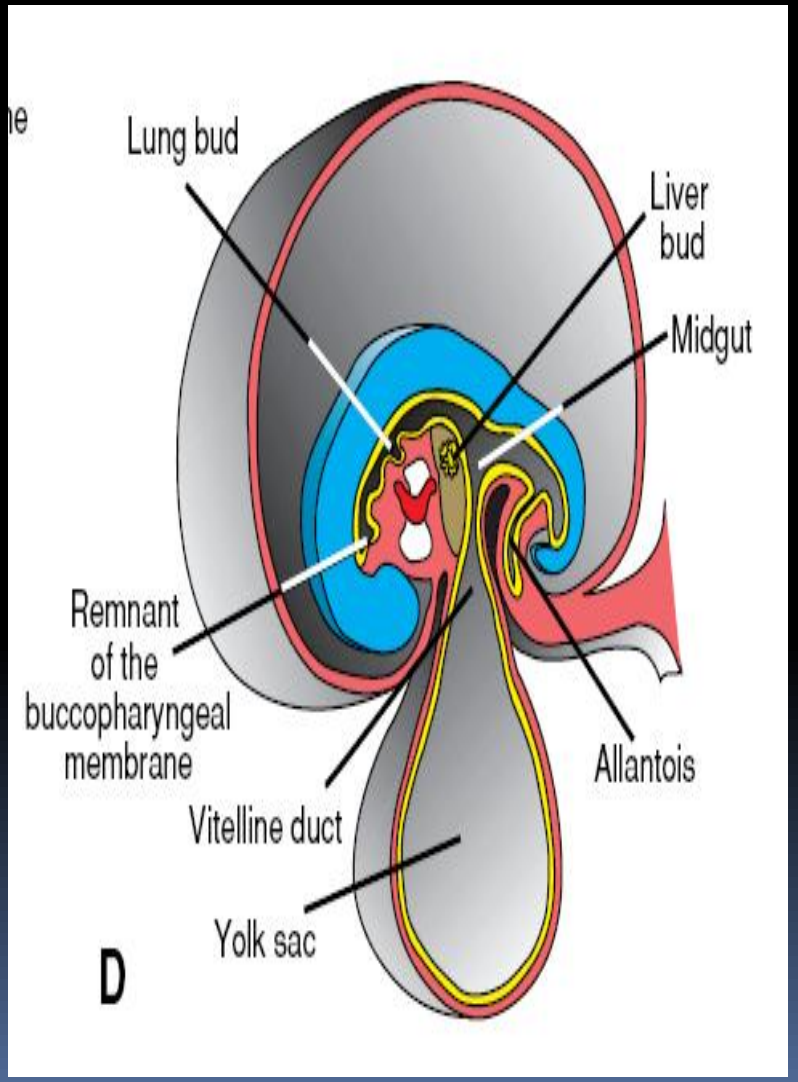
Mid gut

- begins distal to the entrance of the bile duct into the duodenum
- terminates :junction of the proximal 2/3 of the transverse colon with the distal third.



Midgut

- communicates with the yolk sac by way of the **vitelline duct or yolk stalk**
- supplied by the **superior mesenteric artery**
- Development characterized by rapid elongation :**primary intestinal loop**

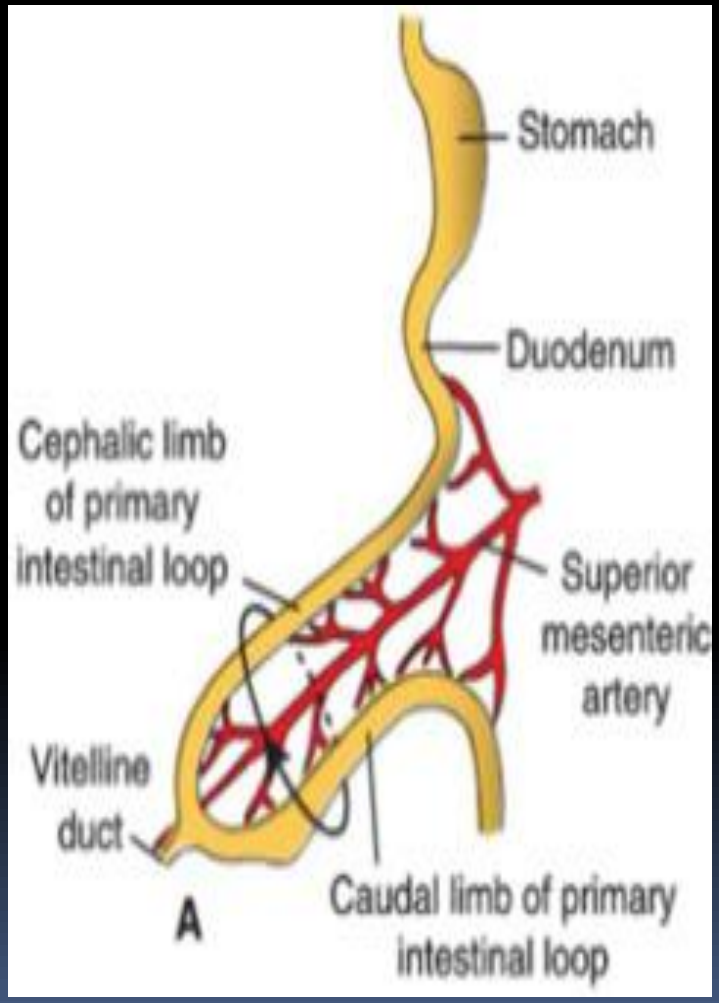


Growth phases of mid gut

1. Herniation – physiologic 6th week
2. Rotation 90 degrees
3. Retraction 10 th week
4. Further rotation 180 degrees

Mid gut growth

- The cephalic limb of the loop develops into: the distal part of the duodenum, the jejunum, and part of the ileum.
- The caudal limb becomes the lower portion of the ileum, the cecum, the appendix, the ascending colon, and the proximal two-thirds of the transverse colon.



Mid gut

- WAPWON.COM_Embryological_Rotation_of_the_Midgut.mp4

Physiological Herniation

- At 6 Weeks

Due to :

- rapid growth of the liver.
- Rapid growth of intestinal loops
- the abdominal cavity becomes too small

they enter the extraembryonic cavity in the umbilical cord

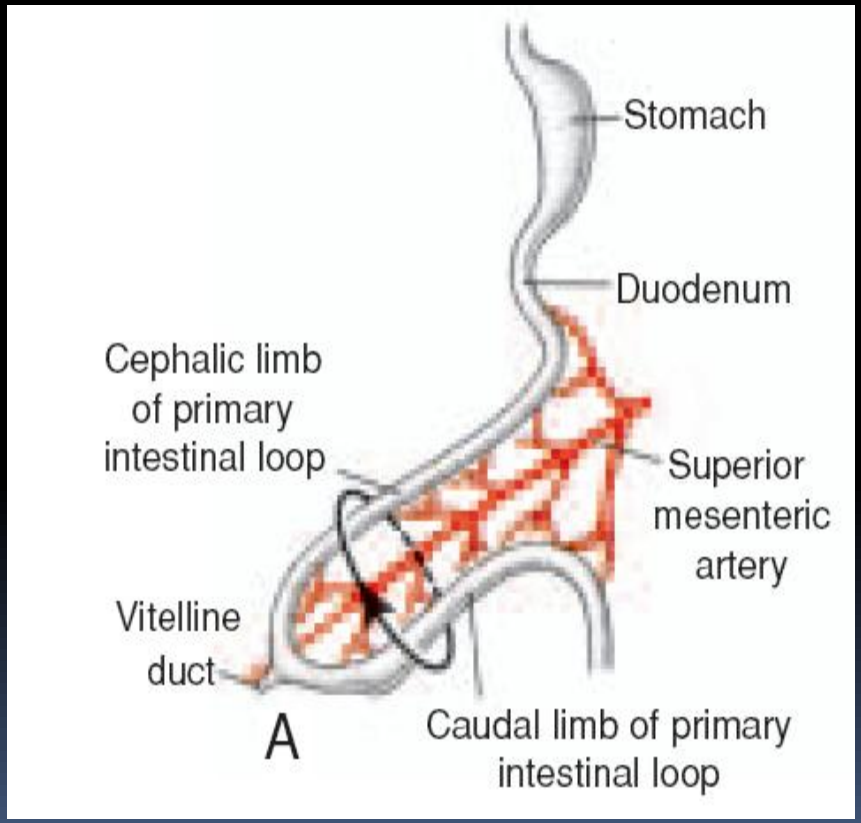
ROTATION OF THE MIDGUT

- rotates around axis of **superior mesenteric artery**

- Counterclockwise
- approximately 270◦ when complete

Rotation occurs :

- during herniation (about 90◦)
- during return of the intestinal loops into the abdominal cavity (remaining 180◦)



during mid gut rotation

Small intestine :

- elongation
- jejunum and ileum :coiled loops

large intestine :

- Elongation
- No coiling

Retraction

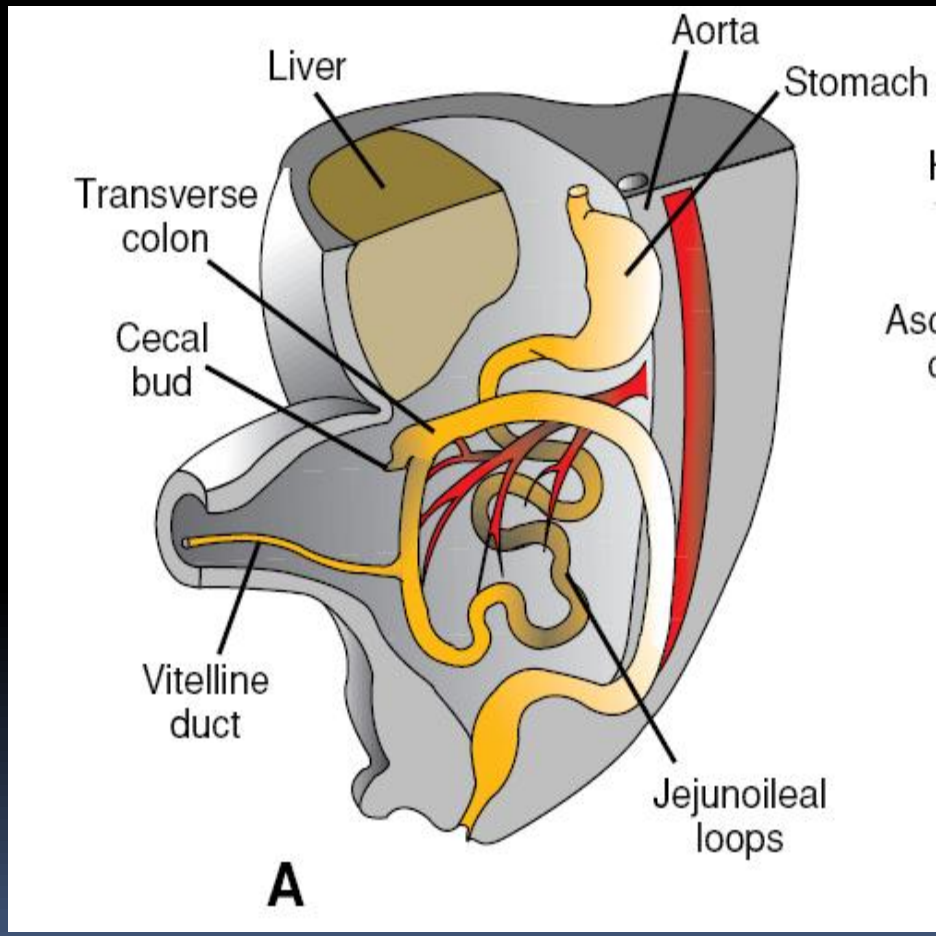
- During the 10th week, herniated loops return to the abdominal cavity.

Due to :

- reduced growth of the liver
- and expansion of the abdominal cavity

- The proximal portion of the jejunum, the first part to reenter the abdominal cavity, comes to lie on the left side

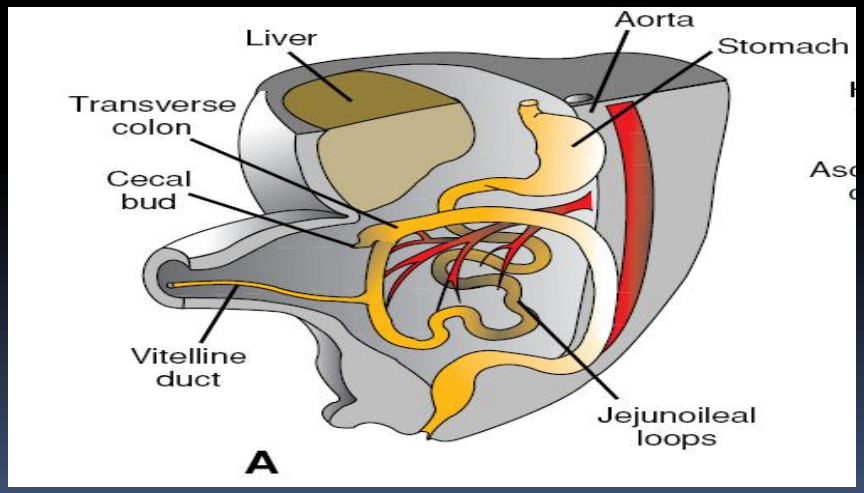
- The later returning loops gradually settle more and more to the right.

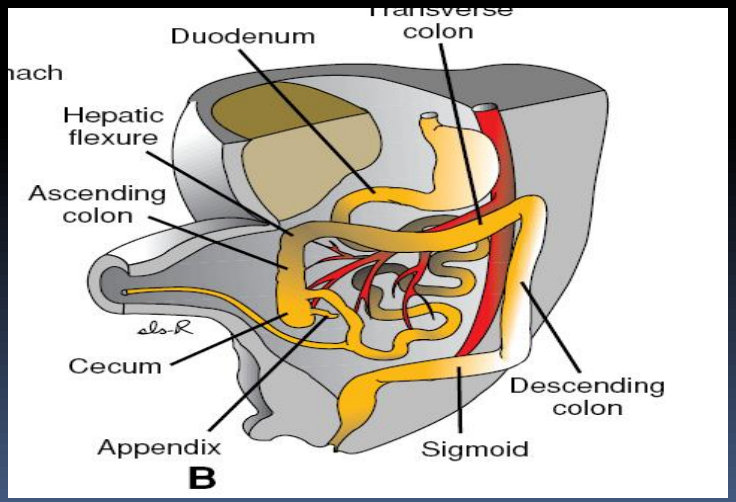


Retraction

- The **cecal bud** is the last part of the gut to reenter the abdominal cavity.

- Temporarily it lies in the right upper quadrant





Appendix embryology

- Forms a s as a narrow diverticulum form cecal bud
- its final position frequently is posterior to the cecum or colon.
- These positions of the appendix are called **retrocecal or retrocolic**

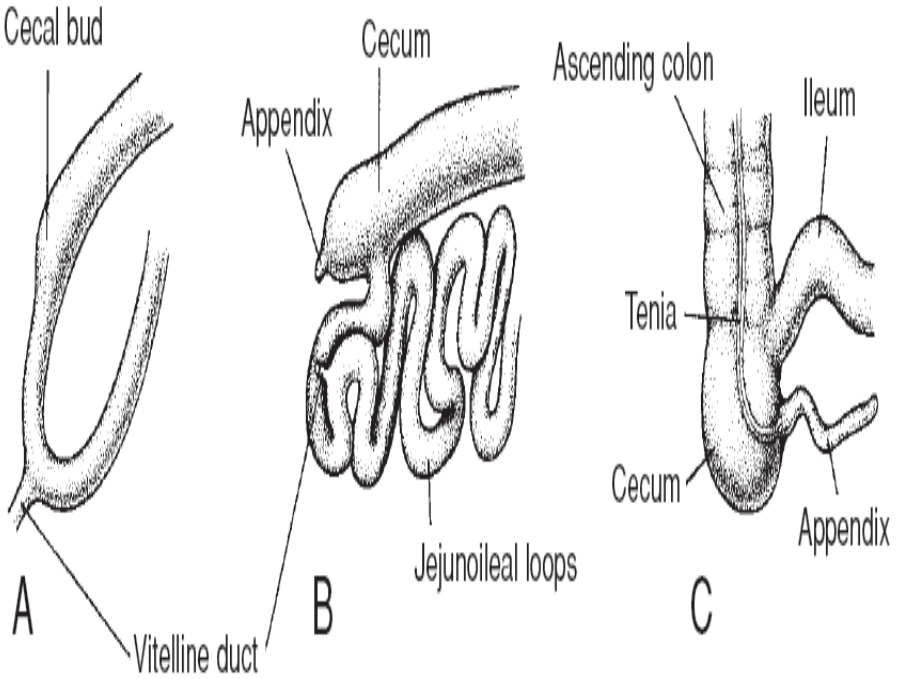
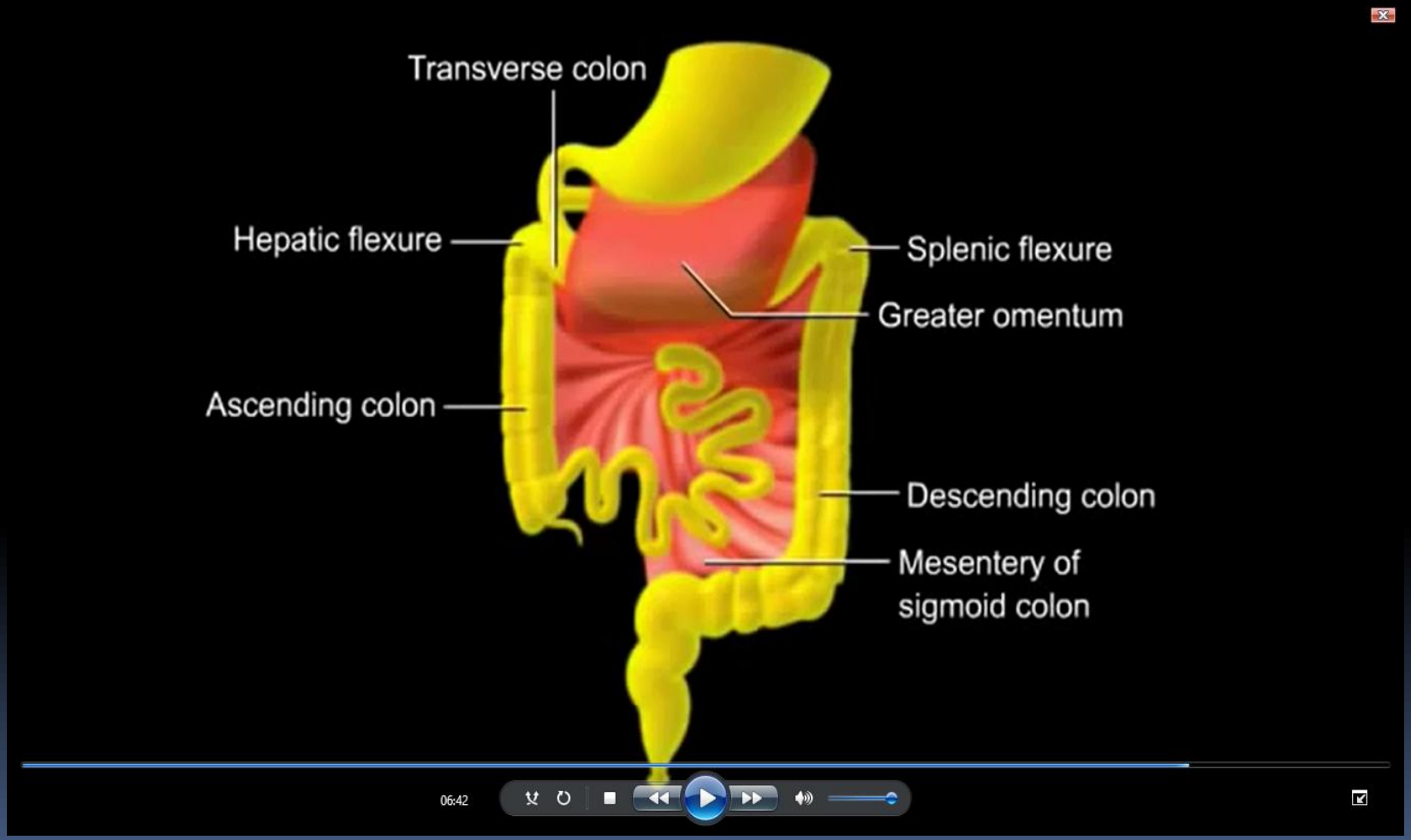
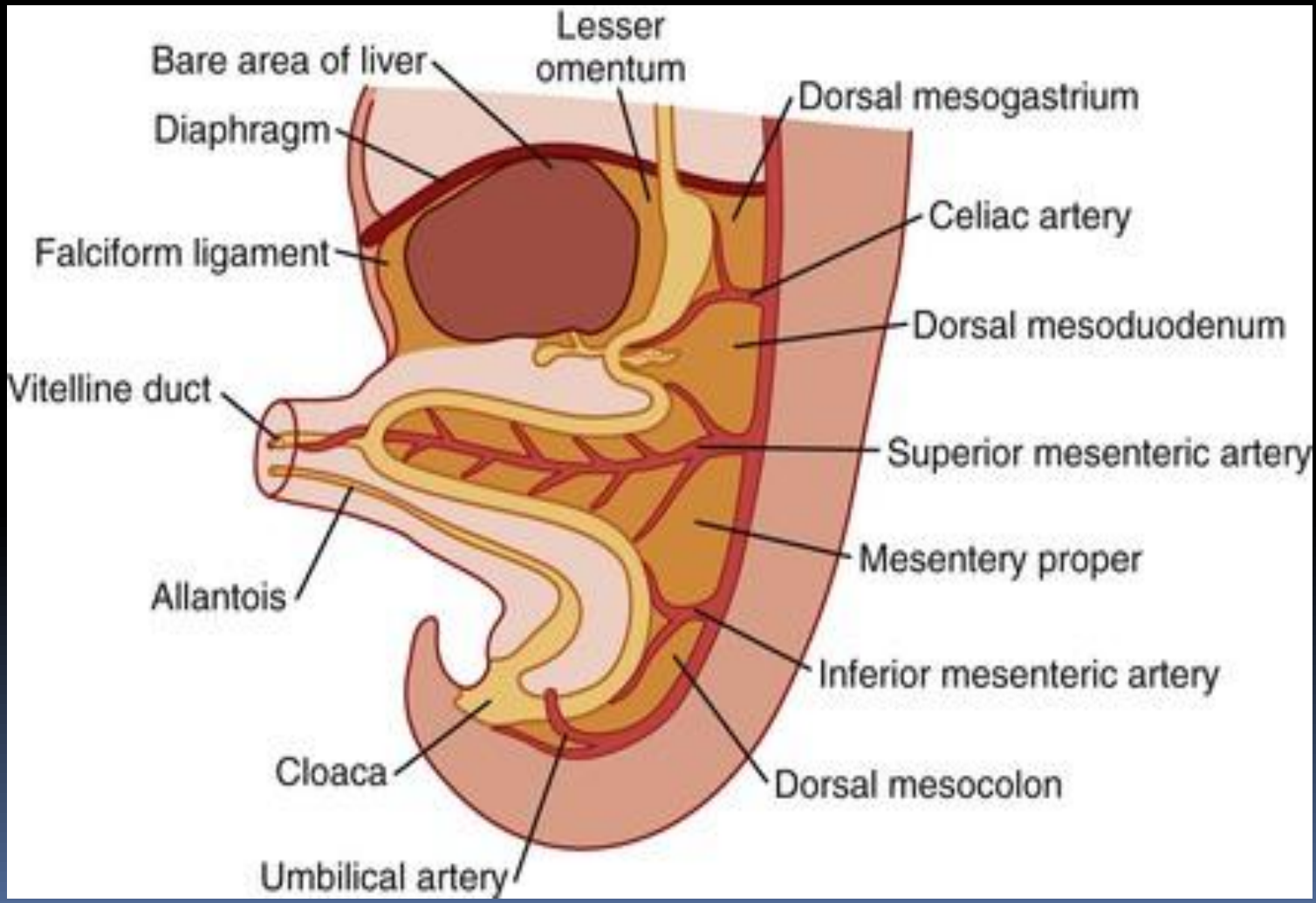


Figure 13.28 Successive stages in development of the cecum and appendix. **A.** 7 weeks. **B.** 8 weeks. **C.** Newborn.

Mesenteries of intestinal loops



Dorsal and ventral mesentry



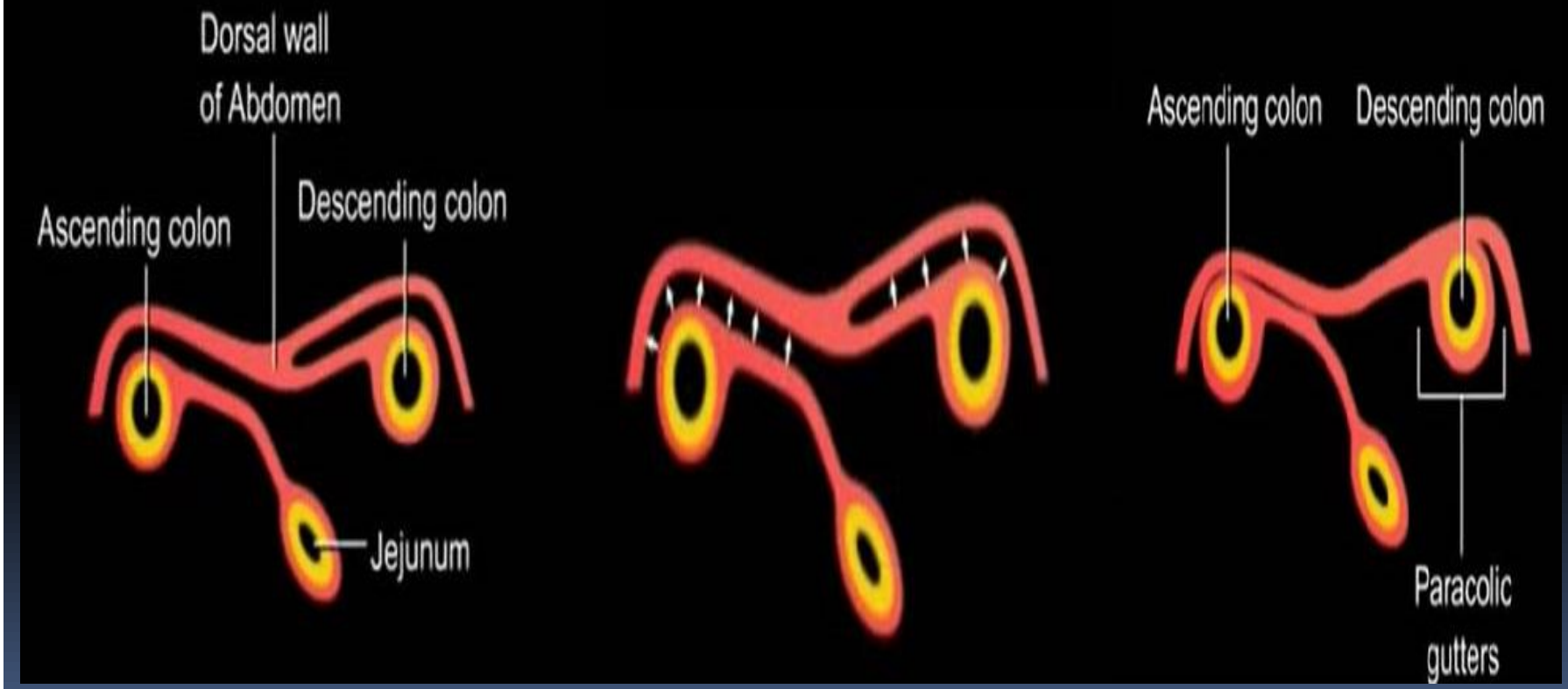
Mesentery proper

- The mesentery of the primary intestinal loop.
- changes with rotation and coiling of the bowel.

1- caudal limb of the loop moves to the right side of the abdominal cavity.

2- the dorsal mesentery twists around the origin of the superior mesenteric artery

Cross sectional view

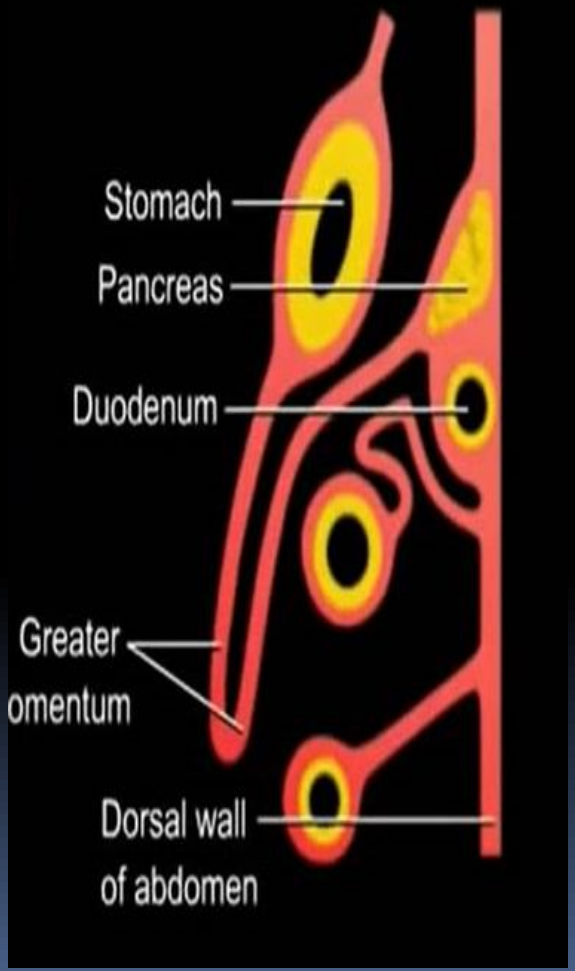


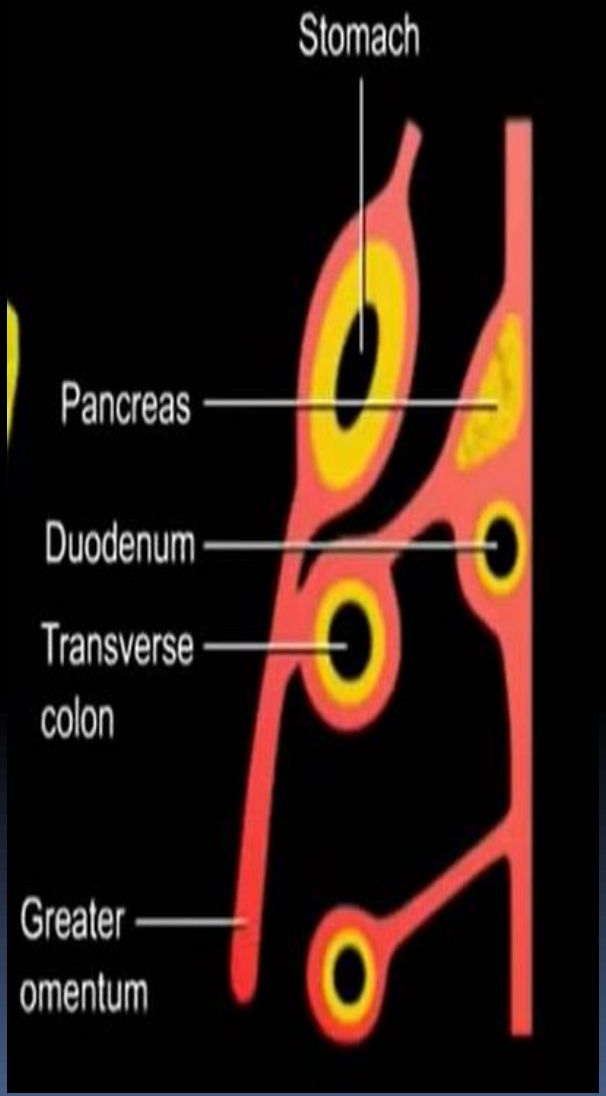
Retro Vs intraperitoneal

- After fusion of these layers:
  - the ascending and descending colons are permanently anchored in a retroperitoneal position
- The appendix, lower end of the cecum, and sigmoid colon: retain their free mesenteries

(intraperitoneal structures)

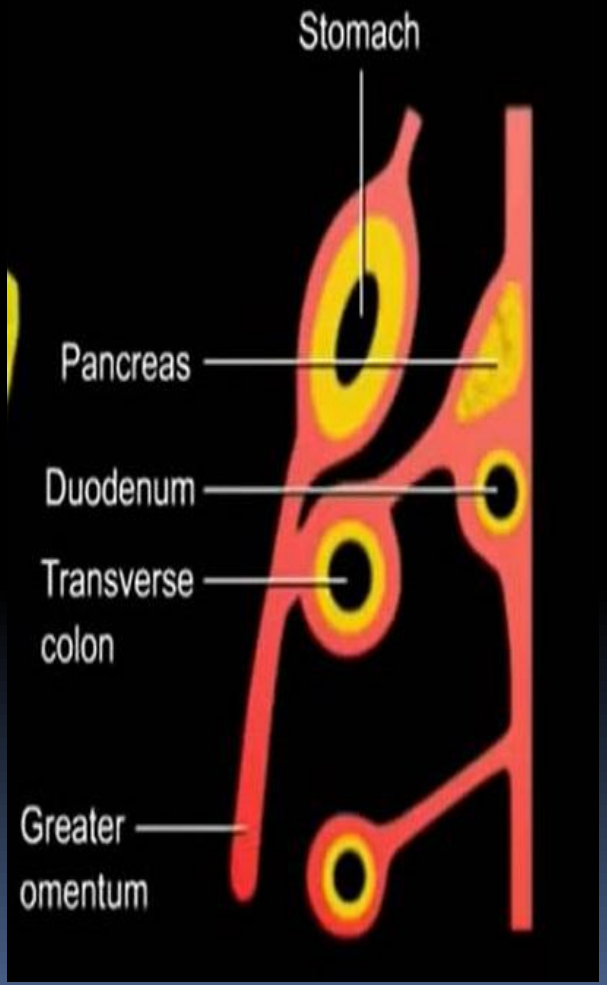
Sagittal view of gut mesenteries





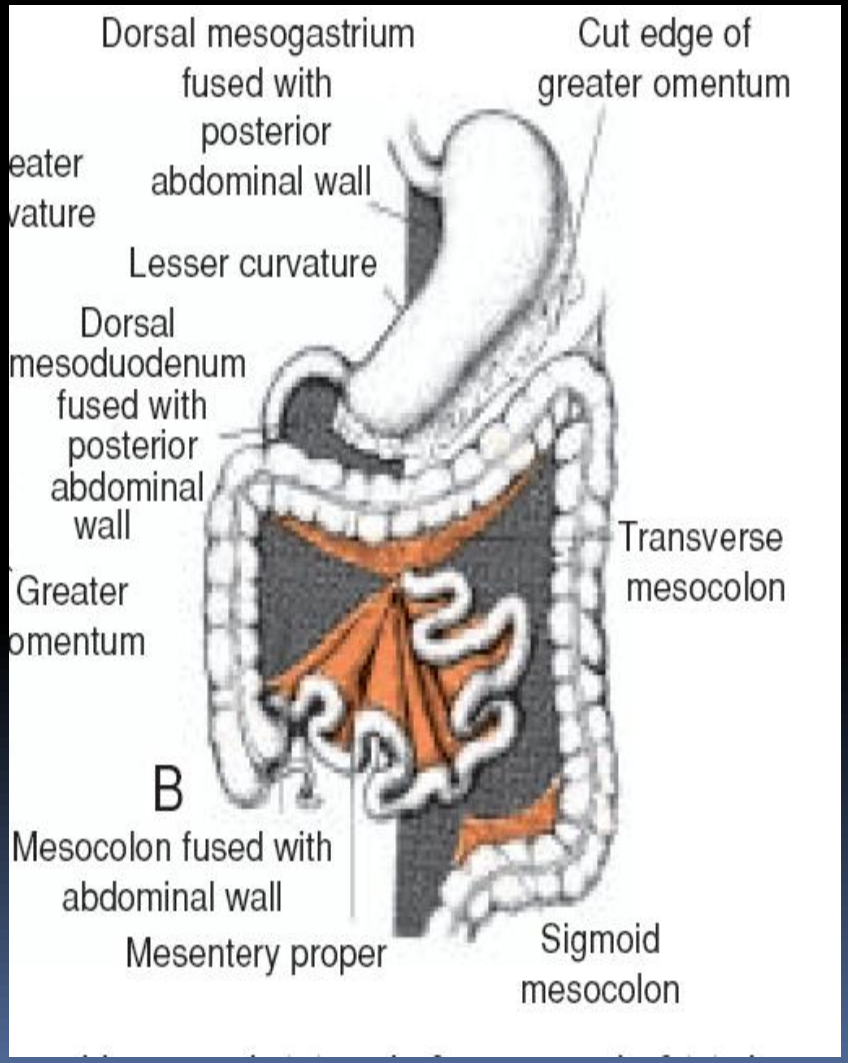
transverse mesocolon

- It fuses with the posterior wall of the greater omentum but maintains its mobility.
- Transverse colon: intraperitoneal organ



Small bowel mesentery

- The mesentery of the jejuno-ileal loops is at first continuous with that of the ascending colon
- Then obtains new attachment line : small bowel becomes intraperitoneal



Congenital anomalies of mid gut

Malrotation

- Anti clock wise roation for 90◦ only.
- When this occurs, the colon and cecum are the first portions of the gut to return from the umbilical cord, and they settle on the left side of the abdominal cavity
- resulting in left-sided colon.
- Results in recurrent vomiting and abdominal pain
- twisting of the intestine (volvulus) compromise s the blood supply.

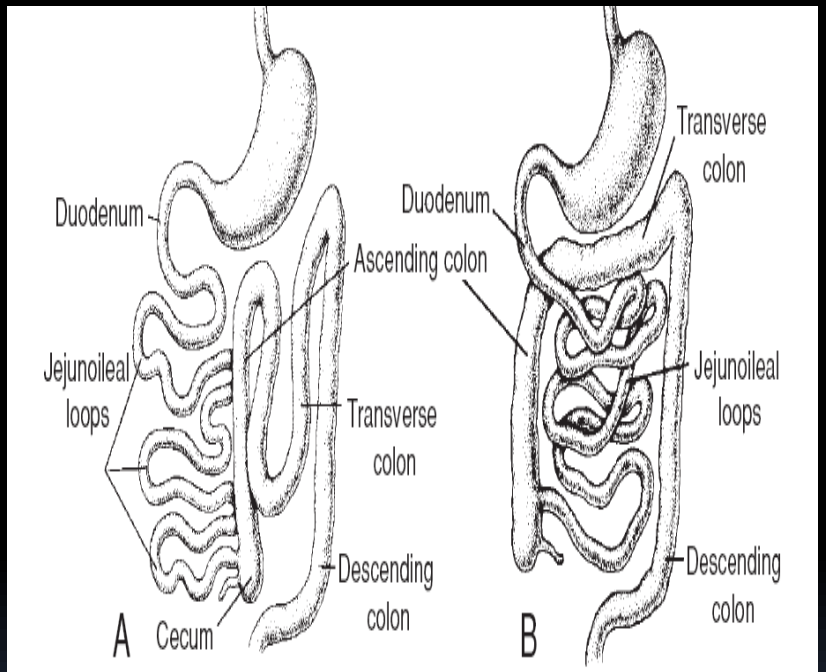
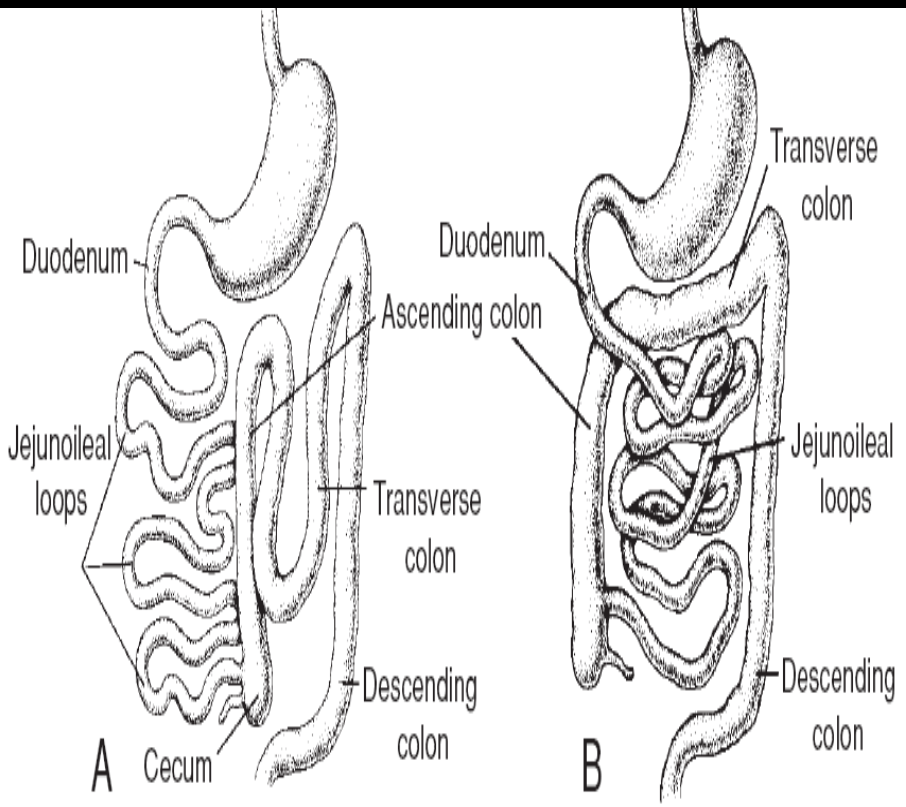


Figure 13.33 A. Abnormal rotation of the primary intestinal loop. The colon is on the left side of the abdomen, and the small intestinal loops are on the right. The ileum enters the cecum from the right. **B.** The primary intestinal loop is rotated 90° clockwise (reversed rotation). The transverse colon passes behind the duodenum.

Reversed rotation

- **primary loop** rotates 90◦ clockwise
- In this abnormality the transverse colon passes behind the duodenum and lies behind the superior mesenteric artery.
- Symptoms usually occur early in life



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Gut Atresias and Stenoses

- **Atresias and stenoses may occur anywhere along the intestine**
- Most occur in the duodenum, fewest occur in the colon, and equal numbers occur in the jejunum and ileum (1/1500 births).
- Atresias in the upper duodenum are probably due to a lack of recanalization

Body Wall Defects

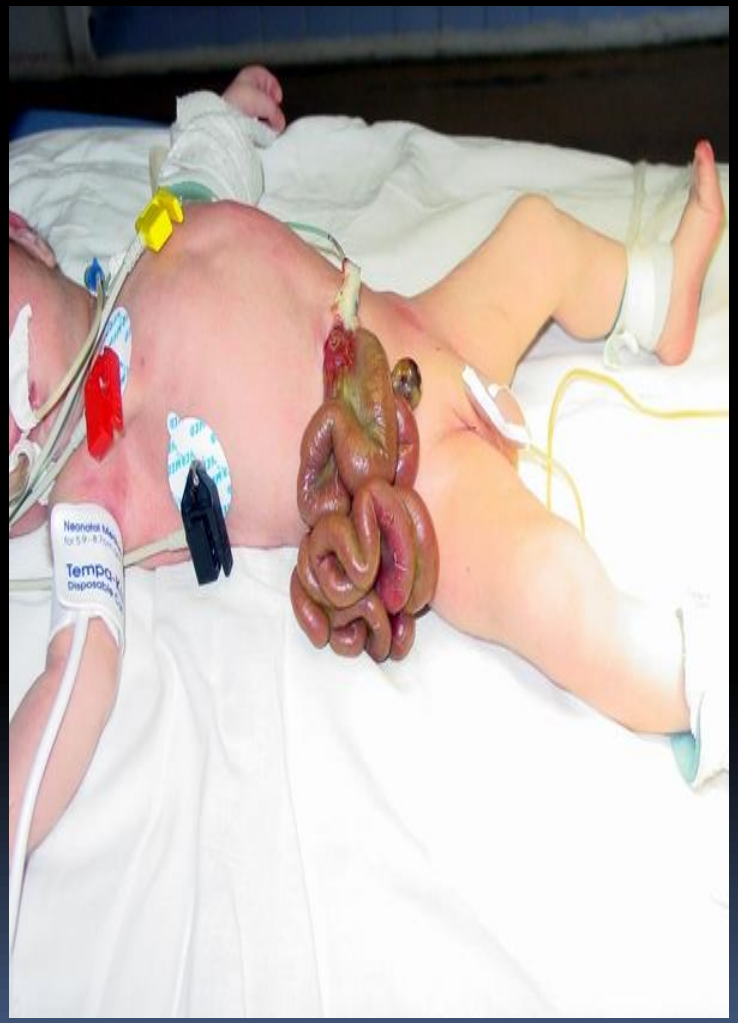
Omphalocele
Gastroschisis

Omphalocele

- herniation of abdominal viscera through an enlarged umbilical ring.
- The viscera are covered by amnion.
- Due to failure of the bowel to retract
- occurs in 2.5/10,000 births
- associated with a high rate of mortality (25%)
- Associated with severe malformations, such as cardiac anomalies (50%) and neural tube defects (40%).
- Approximately half of live-born infants with omphalocele have chromosomal abnormalities.

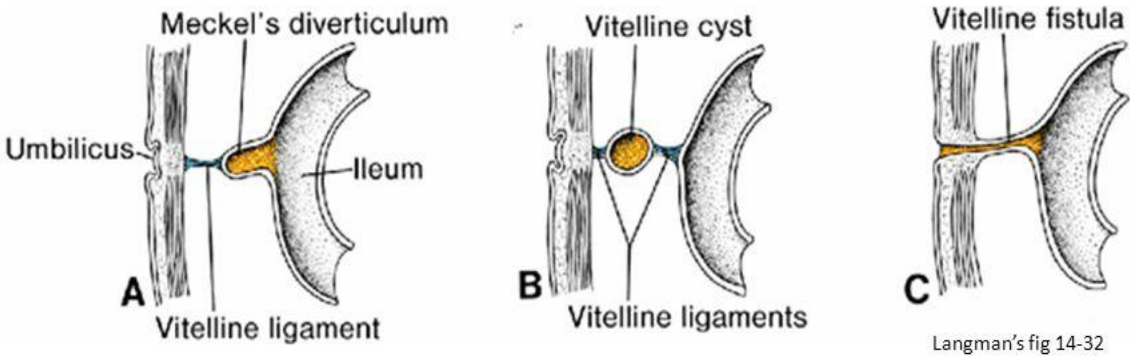
Gastroschisis

- is a herniation of abdominal contents through the body wall directly into the amniotic cavity.
- It occurs lateral to the umbilicus usually on the right
- Not covered with amnion
- Not associated with other anomalies



Vitelline duct abnormalities

Defects associated with gut herniation and rotation: vitelline duct abnormalities



Langman's fig 14-32

Vitelline duct abnormalities of some sort occur in ~2% of all live births. Note that these aberrant structures are almost always found along the ileal portion of the GI tract.

HIND GUT

Case 1

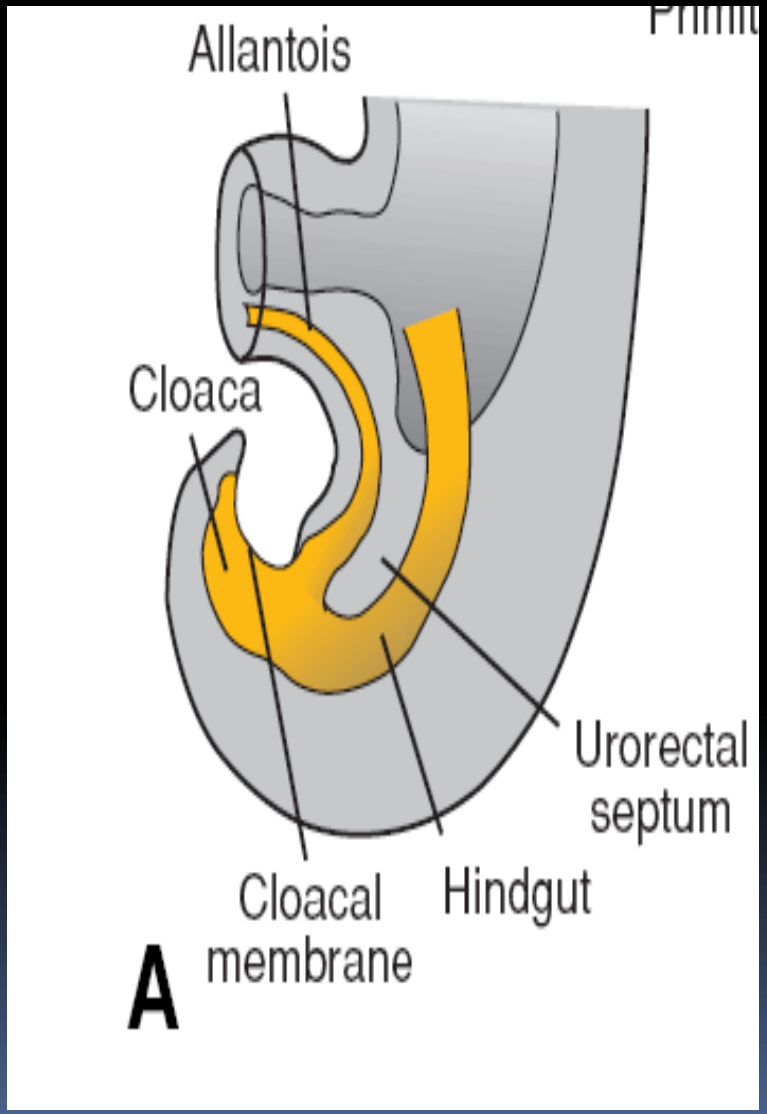
No meconium

Imperforated anus

Hindgut

- gives :
  - the distal third of the transverse colon,
  - the descending colon,
  - the sigmoid,
  - the rectum,
  - and the upper part of the anal canal.

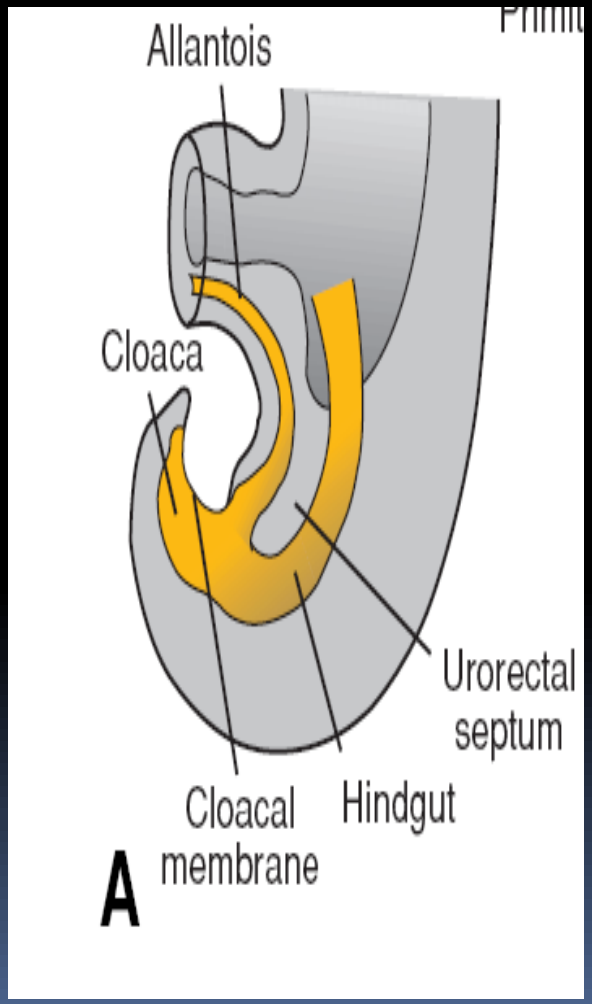
- The endoderm of the hindgut also forms the internal lining of the bladder and urethra
- (from Allantois)



Definitions

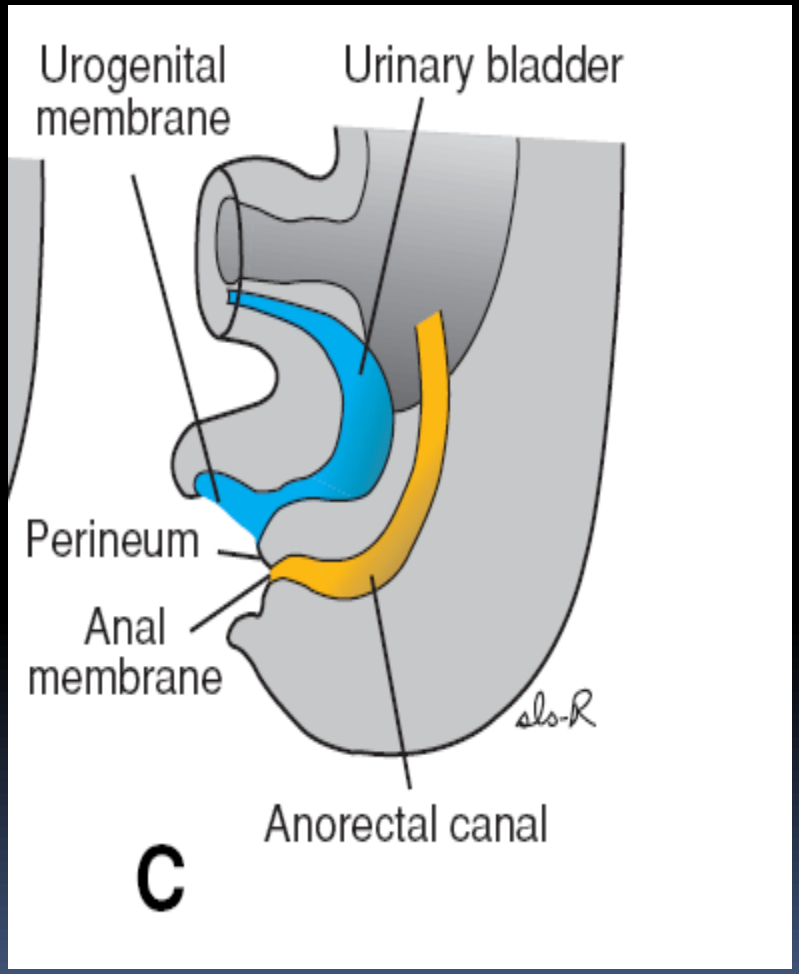
- The cloaca :
  - an endoderm-lined cavity covered at its ventral boundary by surface ectoderm.
- Cloaca membrane:
  - Membrane between hindgut endoderm, and ectoderm
  - Gives rise to anal canal and urogenital sinus openings
- Allantois :
  - ventral extension of the hind gut
  - Gives the uro-genital sinus
- **urorectal septum**

  A layer of mesoderm,, **separates** the region between the allantois and hindgut.



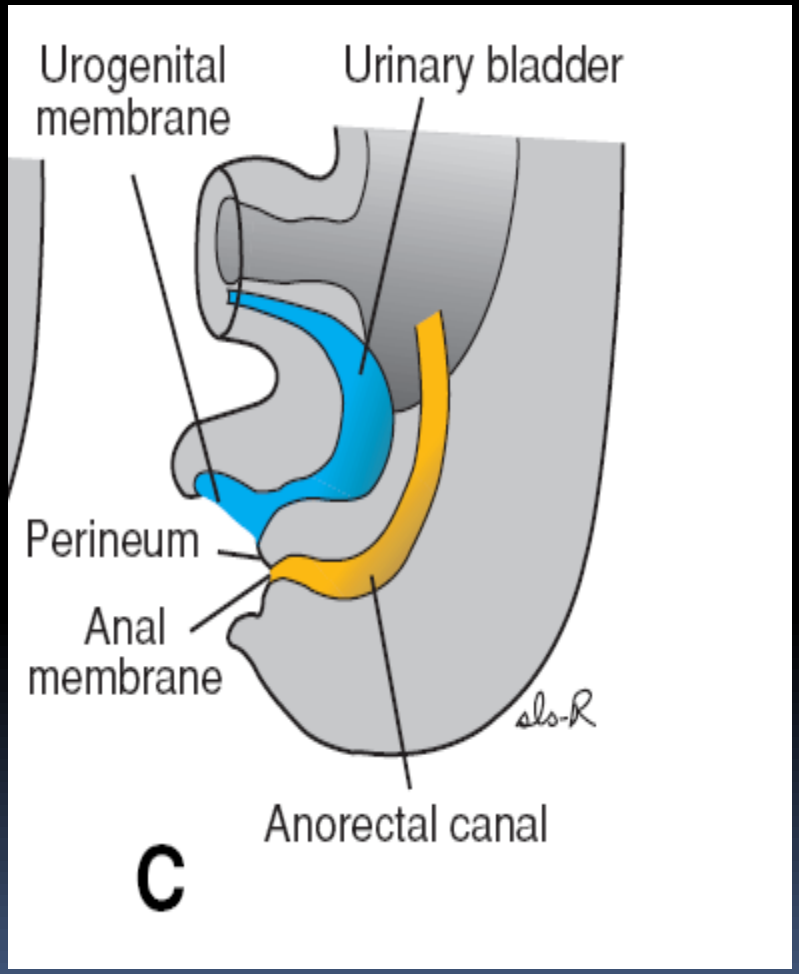
Hind gut embryology

- The terminal portion of the hindgut enters into the posterior region of the cloaca : the primitive **anorectal canal**
- **the allantois enters into the anterior** portion :the primitive **urogenital sinus**



Hind gut embryology

- end of the 7th week:
- cloacal membrane ruptures:
  - Dorsal : anal opening for the hindgut
  - ventral opening for the urogenital sinus.
- The perineal body : the tip of the urorectal septum forms
- proliferation of ectoderm closes the caudal region of the anal canal.
- During the 9th week, this region recanalizes



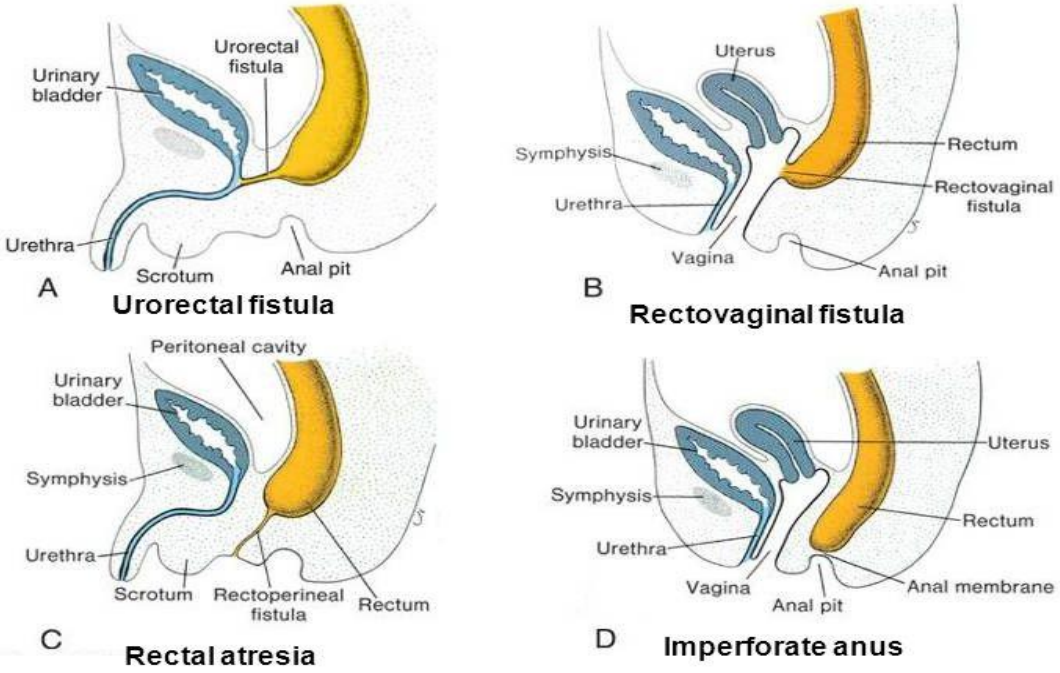
Embryology of anal canal

- distal part :
  - originates in the ectoderm.
  - Stratified squamaous epithelium
  - supplied by the **inferior rectal arteries** (branches of the **internal pudendal arteries**)
- **Proximal part :**
  - **Endoderm**
  - **Coloumnar epithelium**
  - **Supplied by superior rectal arteries (br. Inferior mesenteric artery)**
- **Junction : pectinate line**

Hind gut abnormalities

Gastrointestinal Embryology

Hindgut malformations:



Summary

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THE END

QUESTIONS?