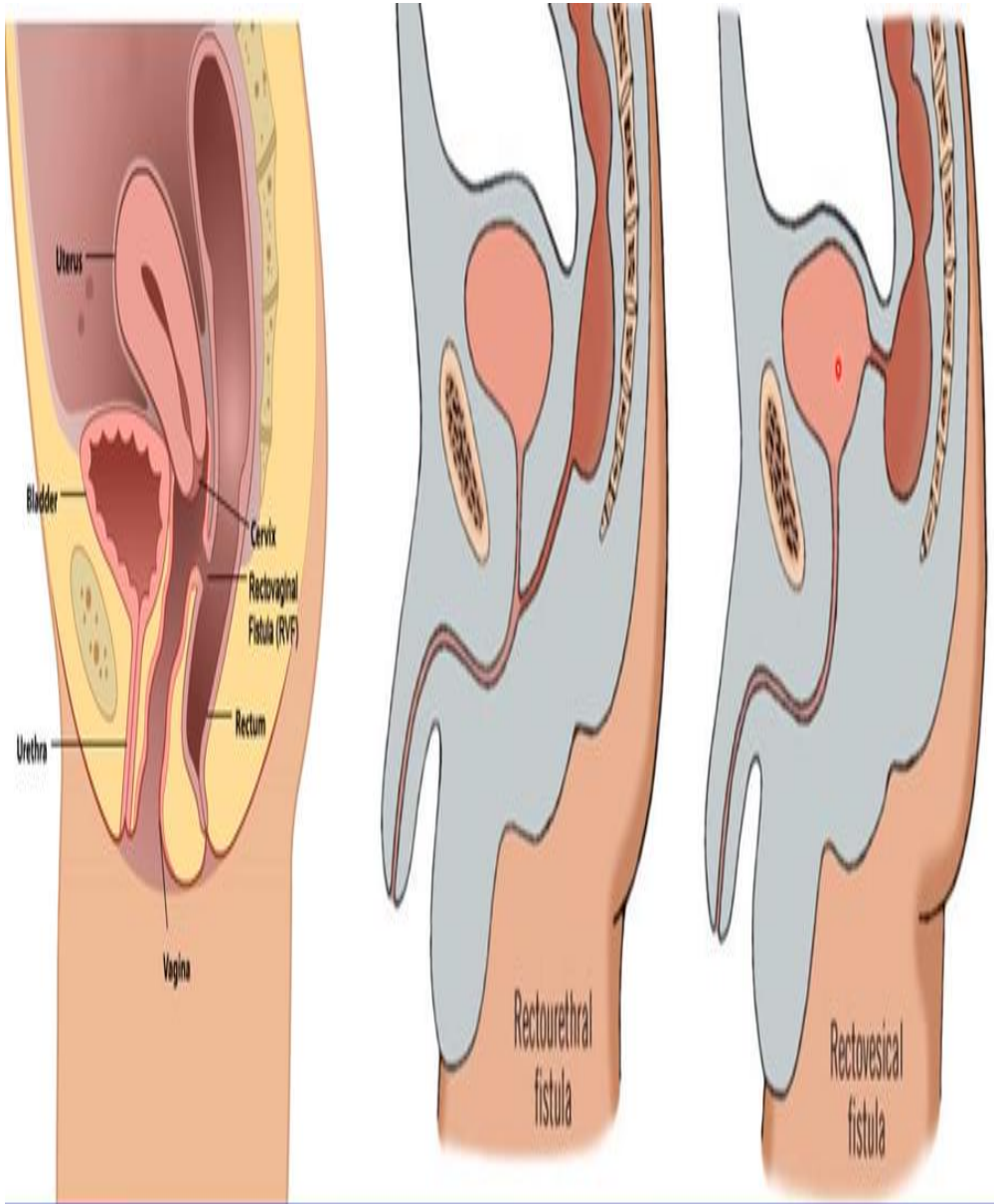
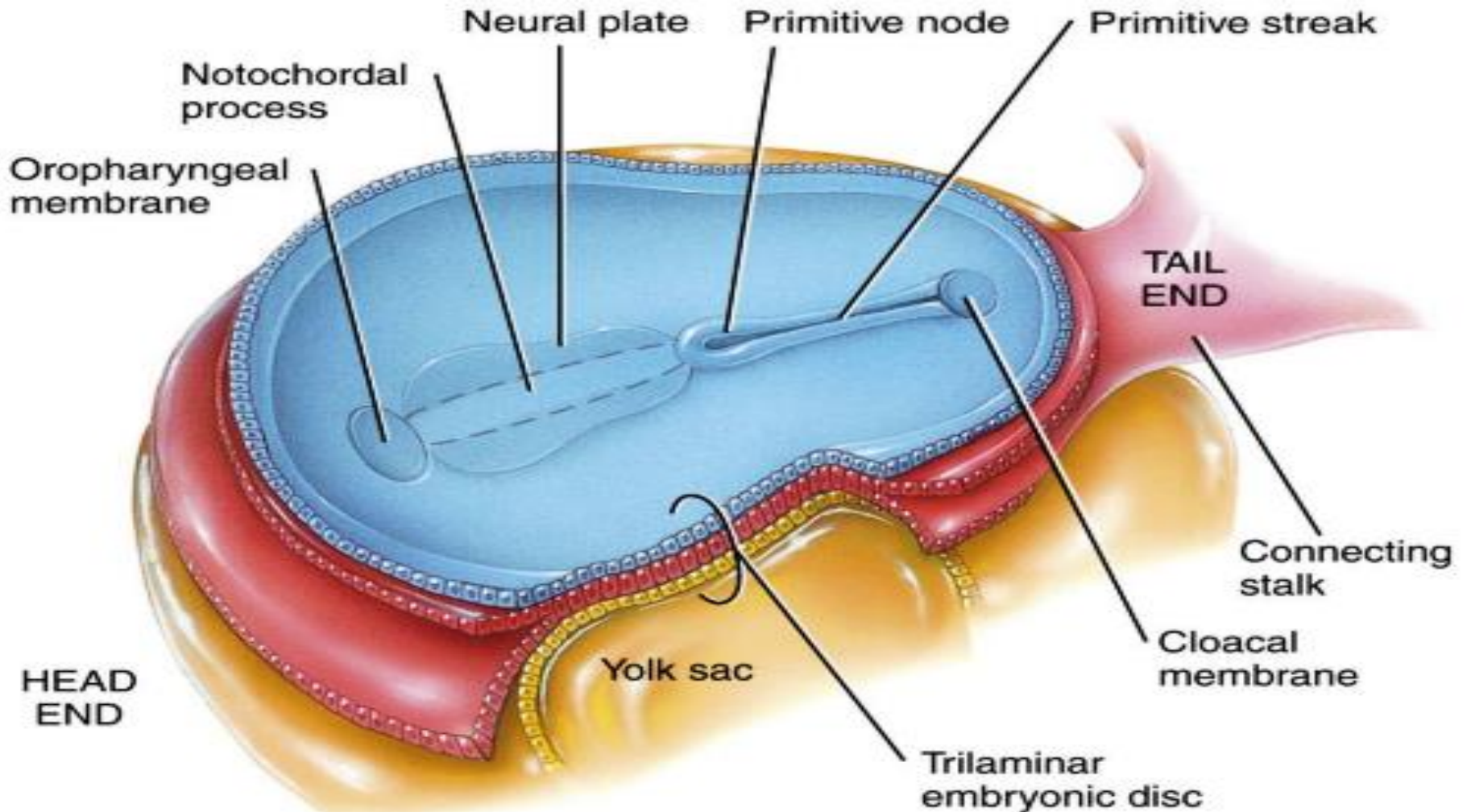


DEV. OF INT. , RECTUM & ANAL CANAL



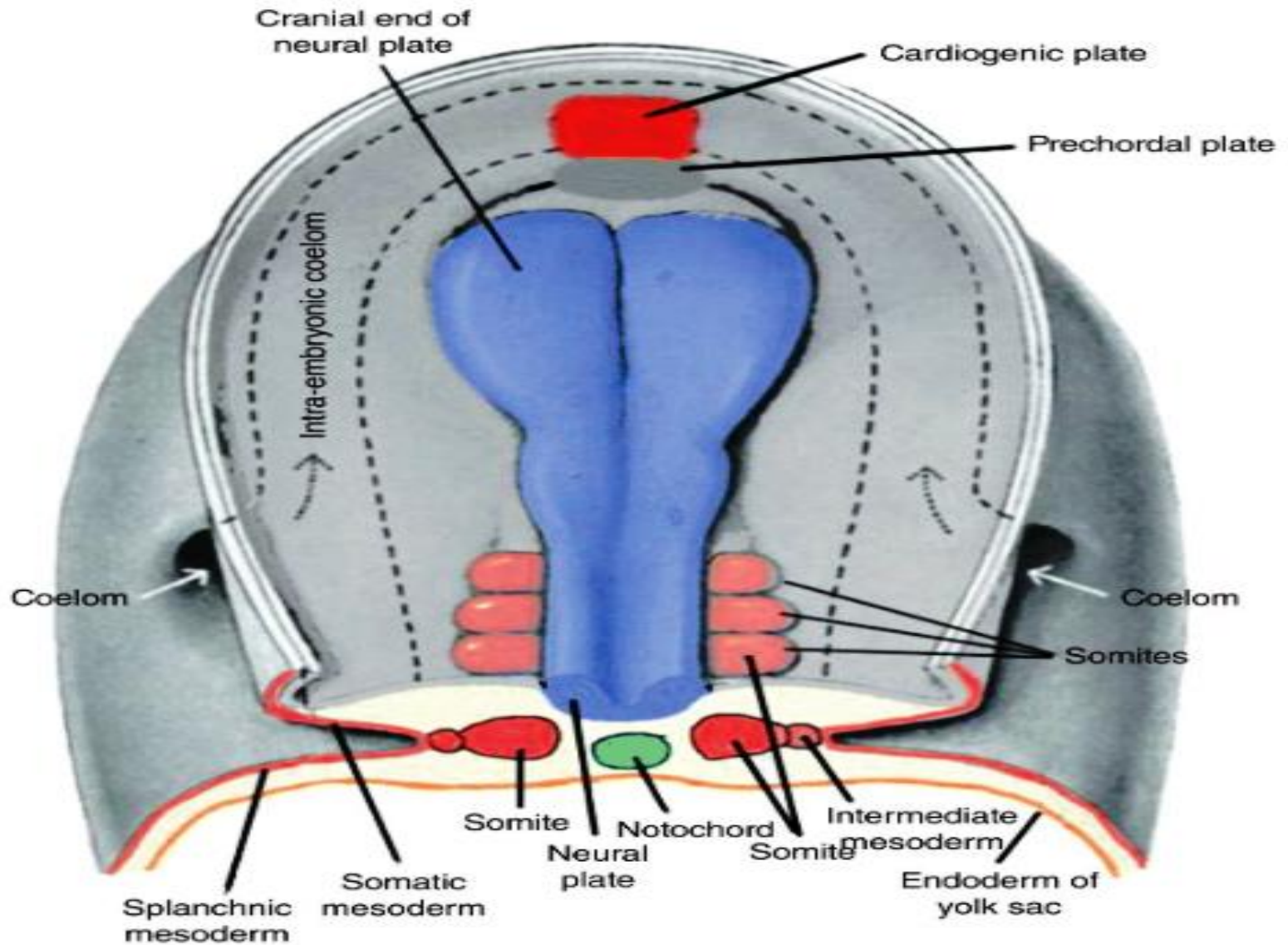
BY
DR ABULMAATY MOHAMED
ASSISTANT PROFESSOR
ANATOMY & EMBRYOLOGY
MUTAH UNIVERSITY

REV.

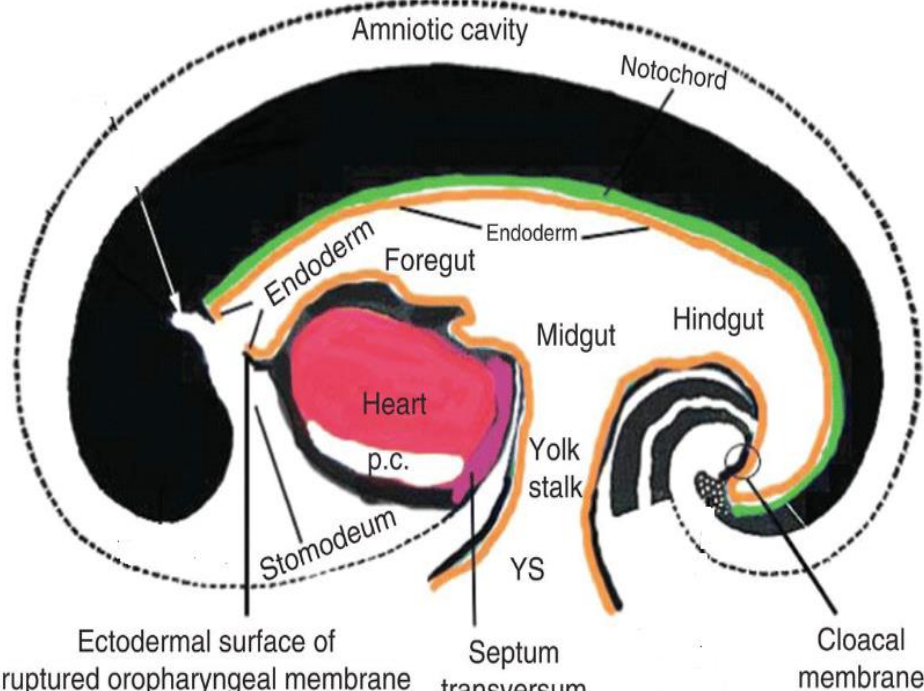
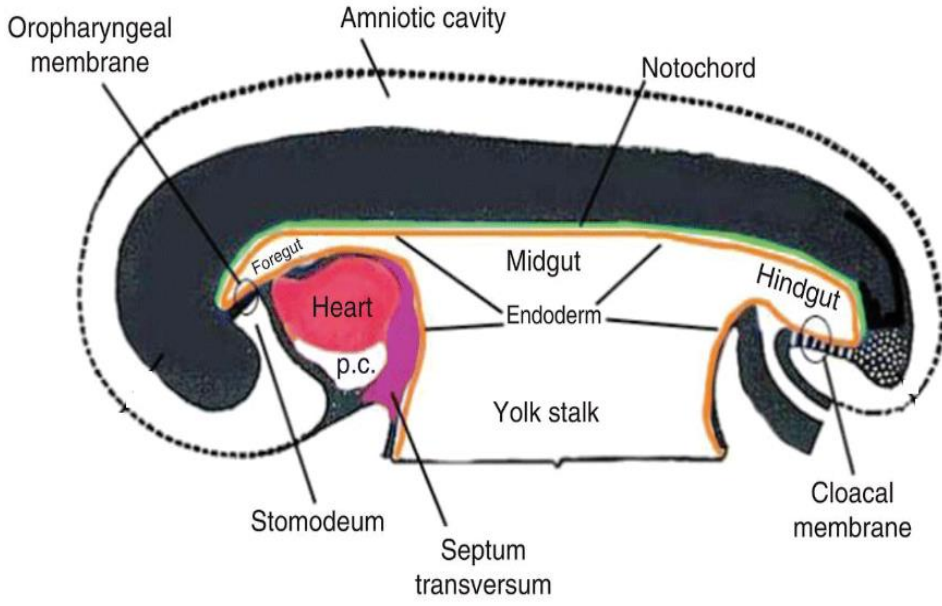
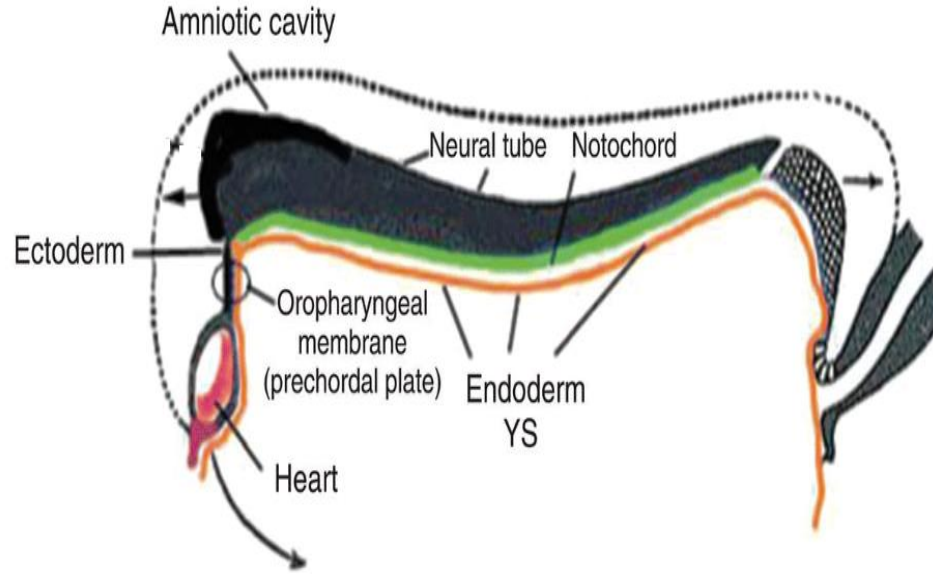
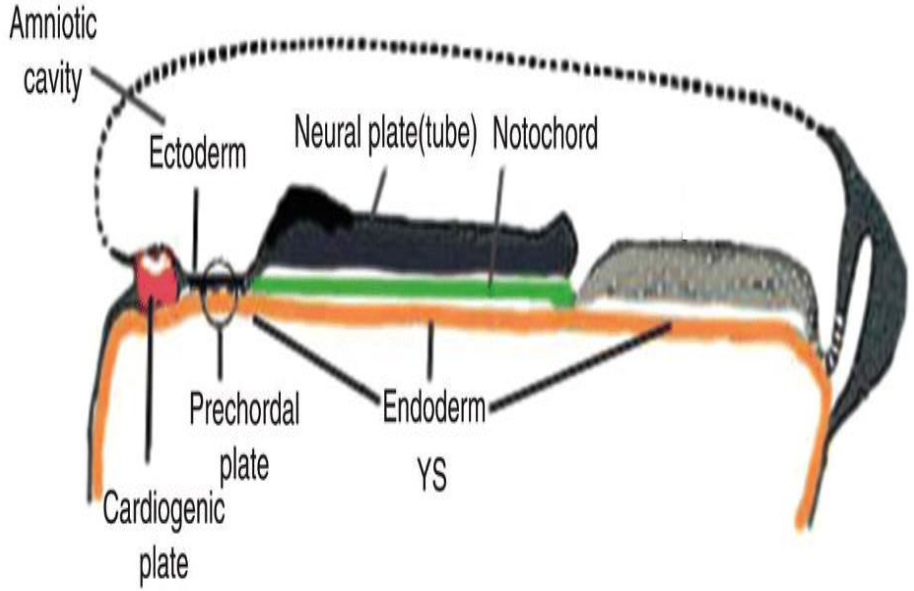


(a) Dorsal and partial sectional views of trilaminar embryonic disc, about 16 days after fertilization

REV.

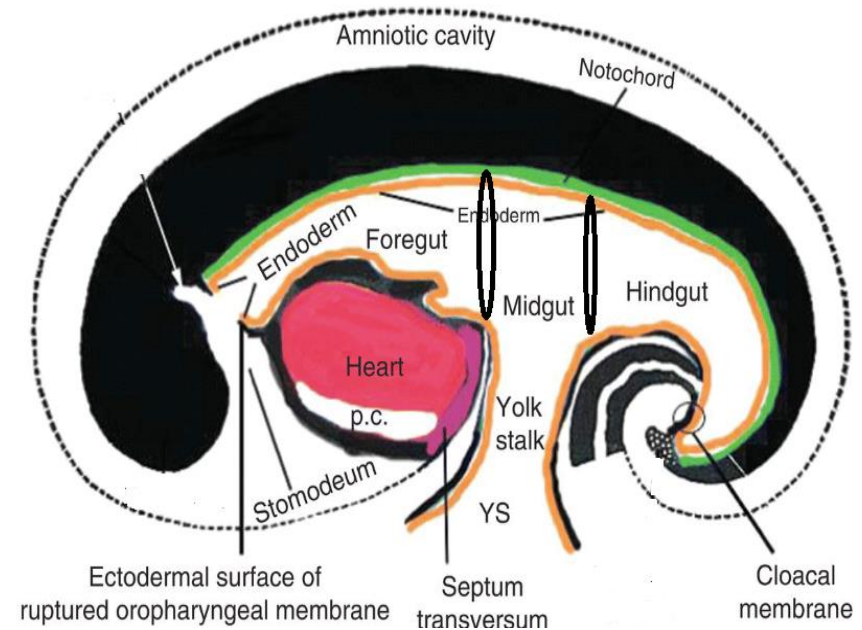


REV.



DIVISIONS OF GUT

-folding of embryonic disc leading to incorporation of large part of the yolk sac (lined by endoderm) inside embryo leading to formation of the primitive gut
primitive gut is divided into 3 parts:



1- foregut: included in head fold & ends blindly by BPM

2- hindgut: included in tail fold & ends blindly by CM

3-midgut: middle part & is connected to the yolk sac by vitellointestinal (vitelline) duct

ant. intestinal portal: junction () foregut and midgut

post. intestinal portal: junction () midgut and hindgut.

-The wall of gut is formed of endodermal lining & covering of visceral (splanchnic) mesoderm.

FOREGUT

Extents:

from buccopharyngeal membrane BPM
to ant. intestinal portal (origin of liver bud).

Parts & derivatives :

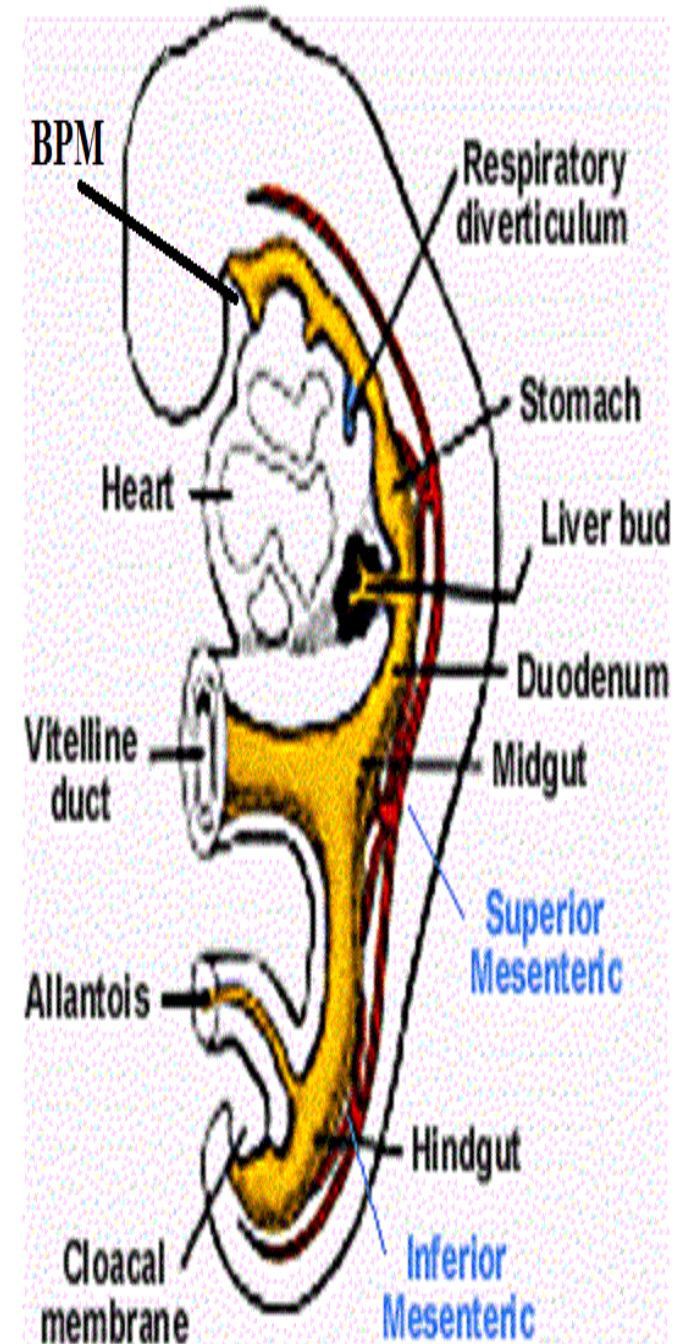
divided by laryngeotracheal(respiratory)
diverticulum into:

1- cranial (pharyngeal) part:

- from the BPM to
- the laryngeotracheal diverticulum
- will form: post. Part mouth cavity and pharynx

2- caudal part:

- from the laryngeotracheal diverticulum
to origin of liver bud
- will form esophagus, stomach ,
upper half of duodenum
liver, pancreas and biliary system



MESENTERY

Def. :- 2 layers of peritoneum connect the organs to posterior & anterior abdominal wall

Ventral mesentery:-

Site:- Connect the gut to anterior abdominal wall

extent:- from lower end of the esophagus

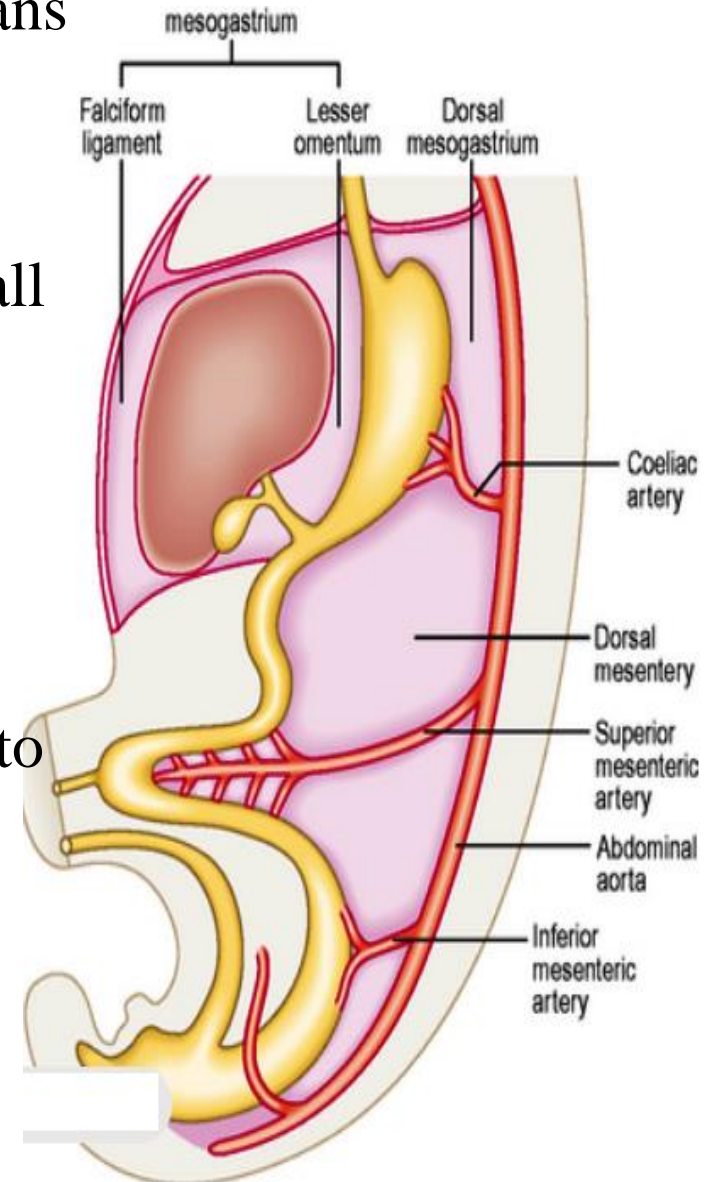
to 1st inch of duodenum

(the part opposite the stomach is called ventral mesogastrium)

Fate:- liver will develop inside it dividing it into

Lesser omentum :- between the liver & gut

falciform ligament:- between the liver & anterior abdominal wall



MESENTERY

Dorsal mesentery:-

Site:- Connect the gut to posterior abdominal wall

extent:- from lower end of the esophagus to rectum

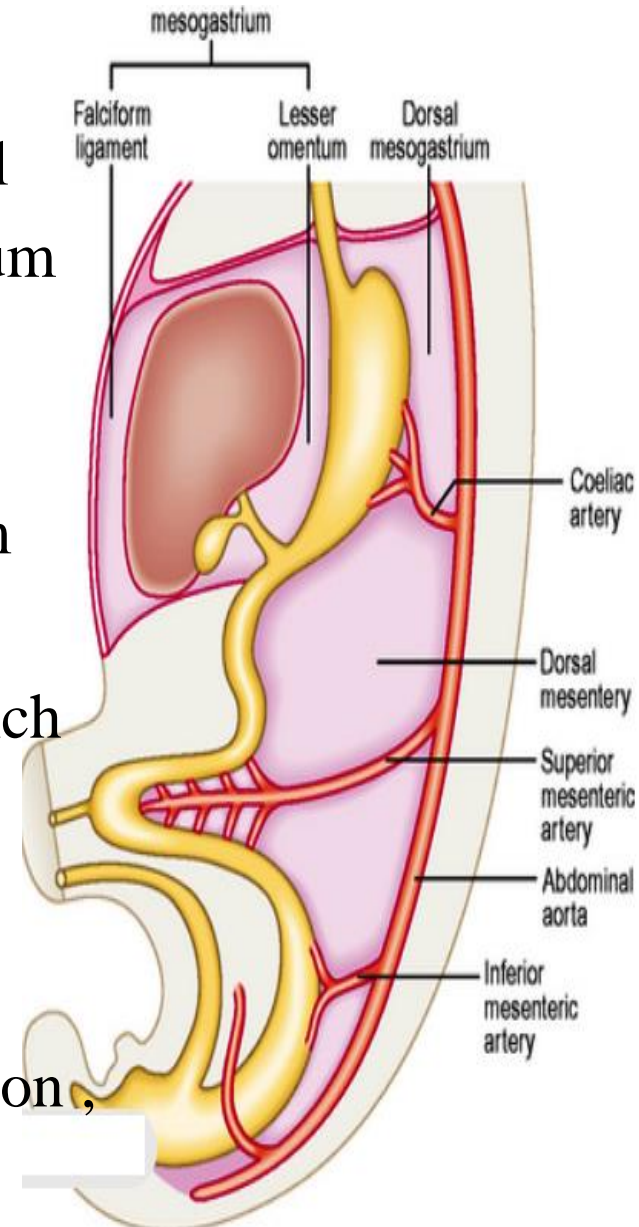
Parts & Fate:-

Dorsal mesogastrium :- opposite the stomach
will form greater omentum

Dorsal mesoduodenum :- opposite the duo.
Will disappear except 1st inch

Mesentery proper:- opposite the jejunum & ileum
will form the mesentery

mesocolon :- opposite the colon
will disappear except transverse mesocolon,
sigmoid mesocolon, mesoappendix



DUODENUM

developmental sources:

1- upper part from terminal part of foregut

2- lower part from proximal part of midgut

N.B: junction () foregut & midgut is marked in adult by

opening of bile duct in second part of duodenum

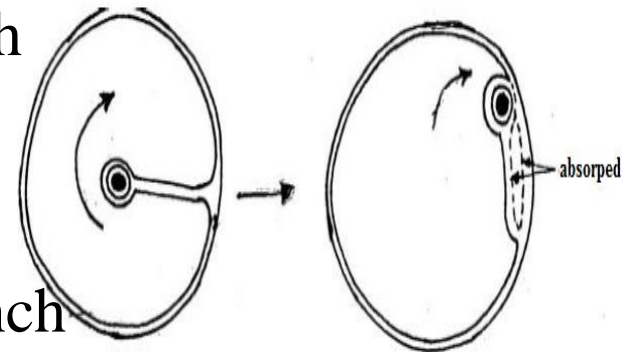
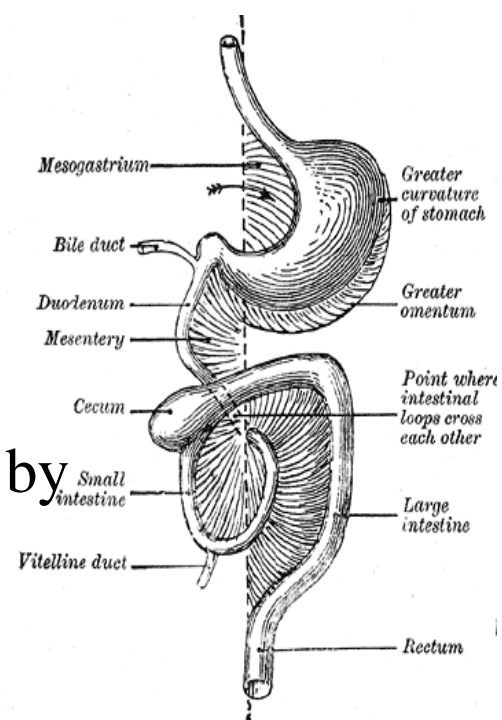
development:

□ terminal part of foregut & proximal part of midgut grow rapidly
formation of u shaped duodenal loop that is convex ant. & covered by peritoneum & attached to post. abd. wall by mesoduodenum

□ loop rotate 90° to Rt due to rotation of stomach
convexity become to Rt

□ Fixation: Mesoduodenum degenerate

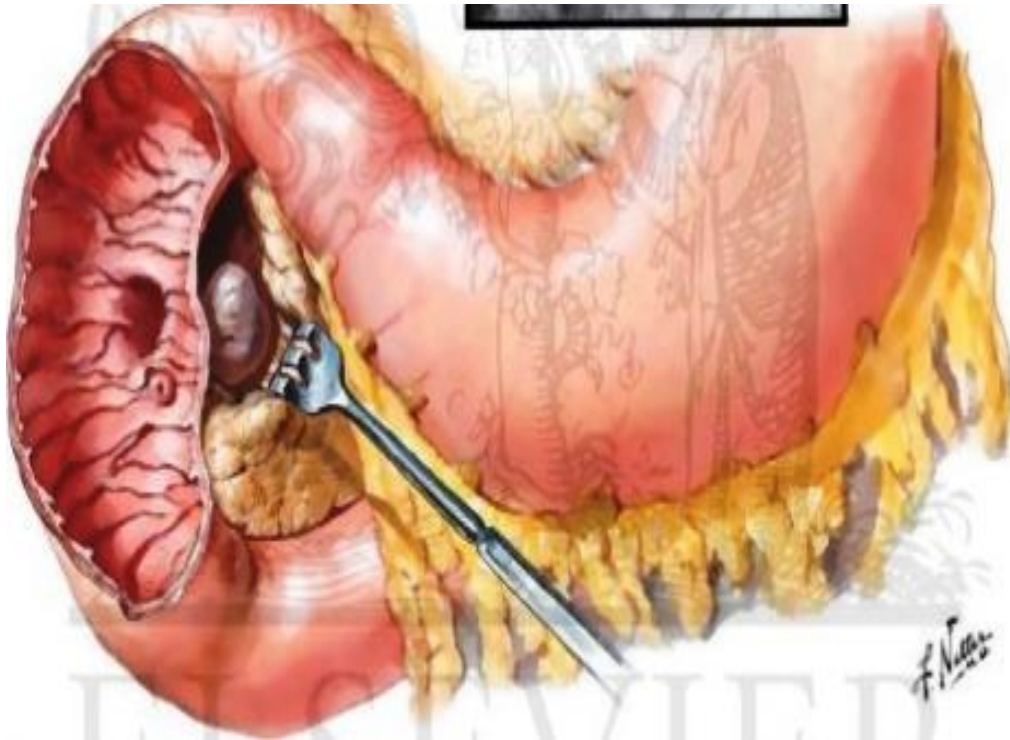
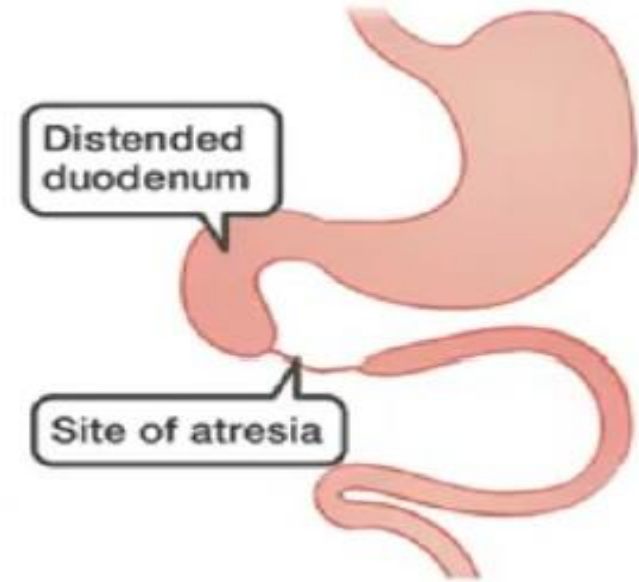
□ duodenum become retroperitoneal except 1st inch



DUODENUM

Congenital anomalies:

- 1- atresia & stenosis
- 2- diverticulae
- 3- persistence of mesoduodenum



MIDGUT

Extent:

from ant. intestinal portal

(site of liver bud)

(in adult opening of CBD in duodenum)

to post. intestinal portal

(In adult junction of Rt 2/3 & Lt 1/3 of transverse colon).

it is connected with yolk sac by vitelline (vitellointestinal) duct

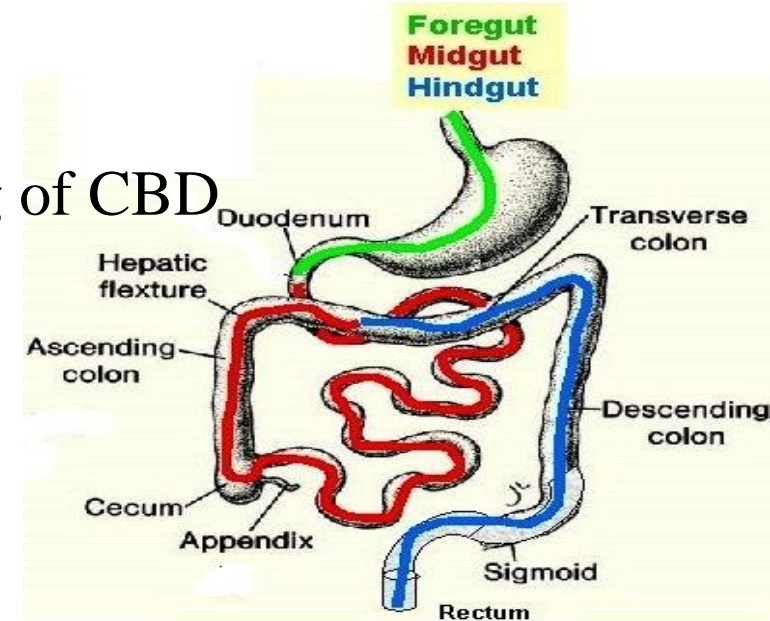
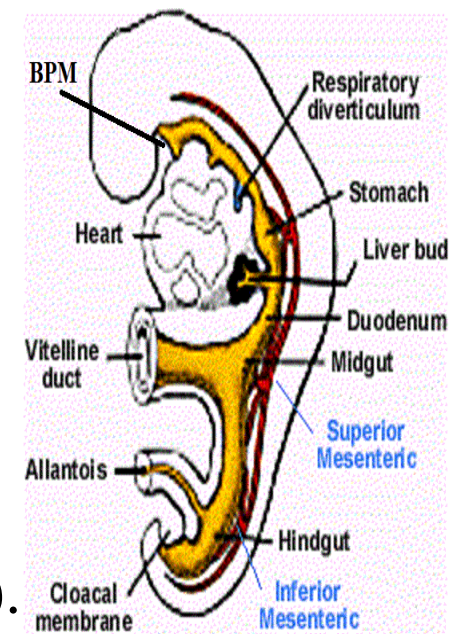
Derivatives (fate):

It gives

- lower half of duodenum caudal to opening of CBD

- jejunum, ileum, appendix, caecum,

ascending colon & Rt 2/3 of tr. colon



MIDGUT

Development:

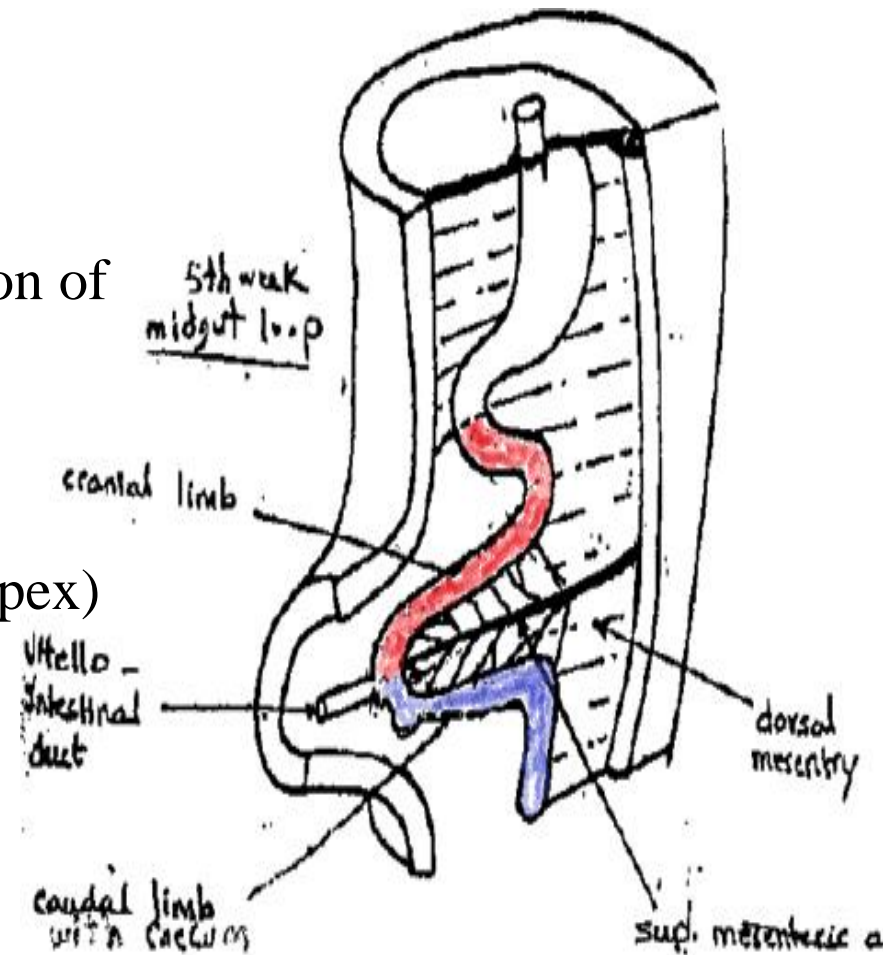
□ primary midgut (intestinal) loop:

midgut grows rapidly in length → formation of U shaped loop that is formed of

- 1- cranial limb
- 2- apex connected to vitelline duct
- 3- caudal limb with swelling (close to the apex) that will form caecum
- 4- superior mesenteric art. along its axis (in its dorsal mesentery)

□ physiological umbilical hernia:

- at 6th week of dev., the rapidly elongating loop herniate into umbilical cord through umbilical orifice
- herniation is due to inability of abd. cavity to accommodate rapidly growing mid gut due to
 - 1-slow growth of abd. cavity
 - 2-development of liver & kidney



MIDGUT

Development:

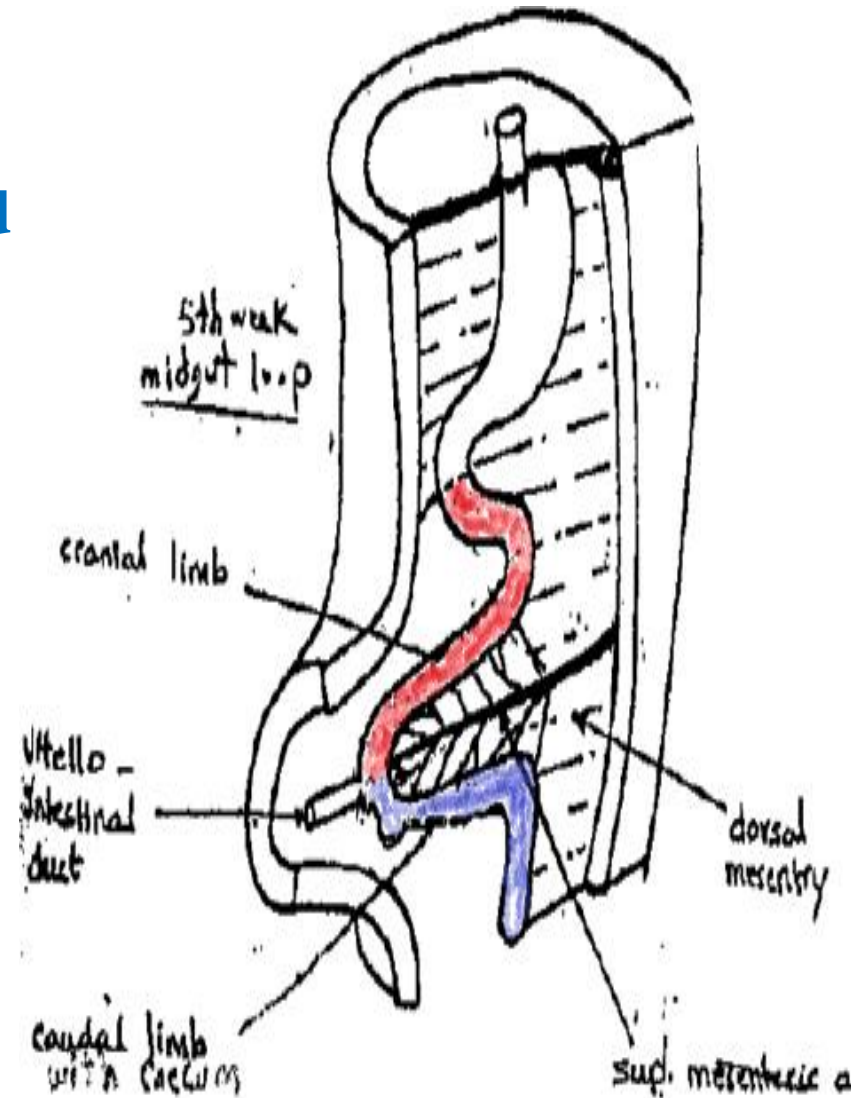
□ While the loop in the umbilical cord

-The cranial limb form

the lower 1/2 of duodenum,
jejunum and greater part of ileum

-The caudal limb also form

the distal part of ileum,
caecum,
appendix,
ascending colon
and Rt 2/3 of transverse colon



MIDGUT

Development:

□ rotation of the intestinal loop

-Due to further elongation of loop.
-Total 270 anticlockwise
around its long axis formed by SMA.

-While in umbilical cord, it rotates:

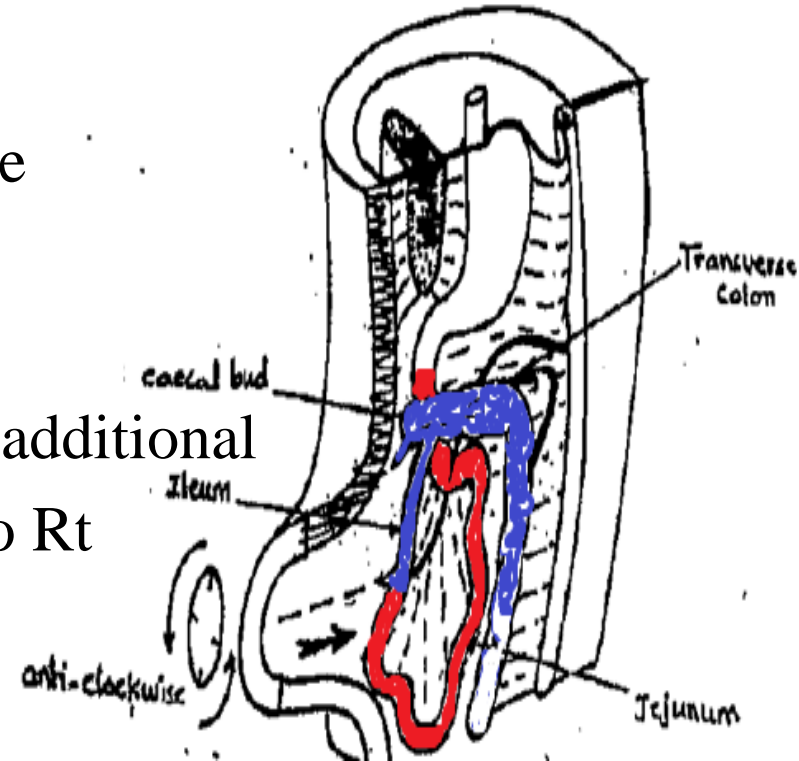
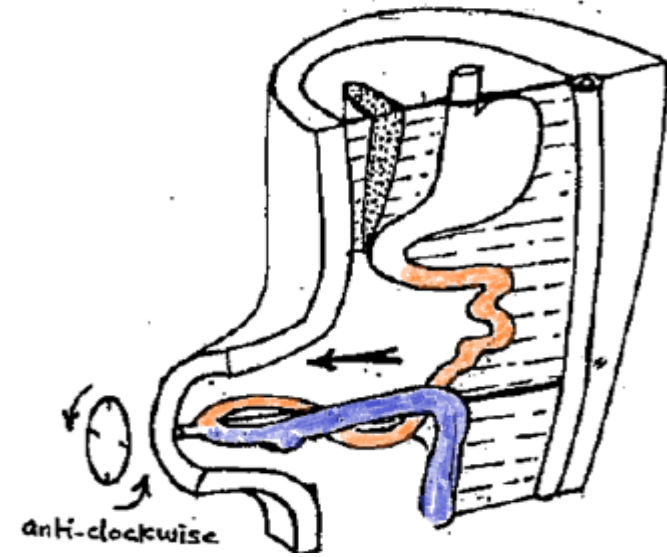
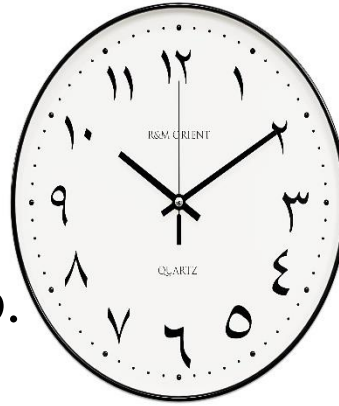
90 → caudal limb become to Lt &
cranial limb become to Rt., then rotate

90 → caudal limb become cranial &
cranial limb become caudal

- As the gut returns to abd cavity, it rotates additional

90 → the caudal limb (tr. Colon) become to Rt
& crosses (become superficial)

to the cranial limb (2nd part of duodenum)



MIDGUT

Development:

□ return of the loop:

-at 10th week of dev., the abd. cavity become wide enough to accommodate the intestine → return of physiological hernia

-jejunum is the 1st part to return into abd cavity & lies on the Lt side

-caecum is the last part to return into abd cavity & lies with the appendix

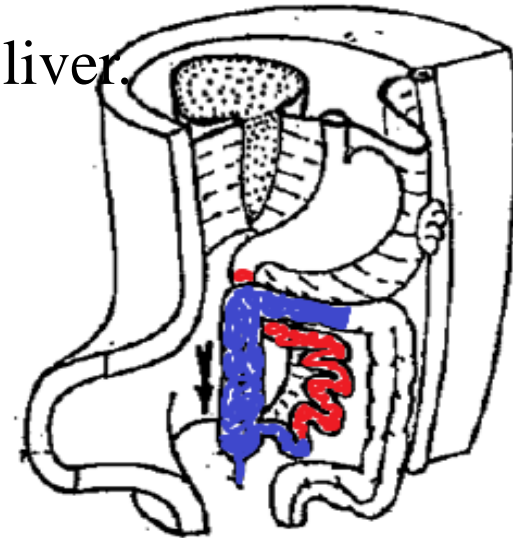
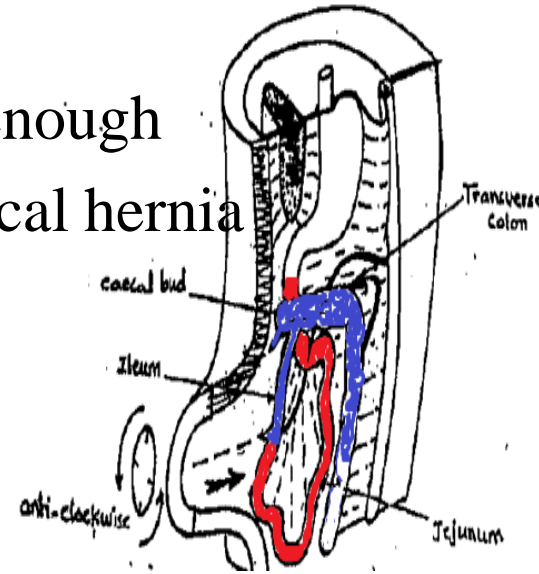
on the Rt side , below and in contact with Rt lobe of liver.

□ caecum and appendix descend

to Rt iliac fossa due to elongation

of the segment () caecum & tr. Colon

to form Rt colic flexure and ascending colon



MIDGUT

Development

- **change the site of opening of appendix**

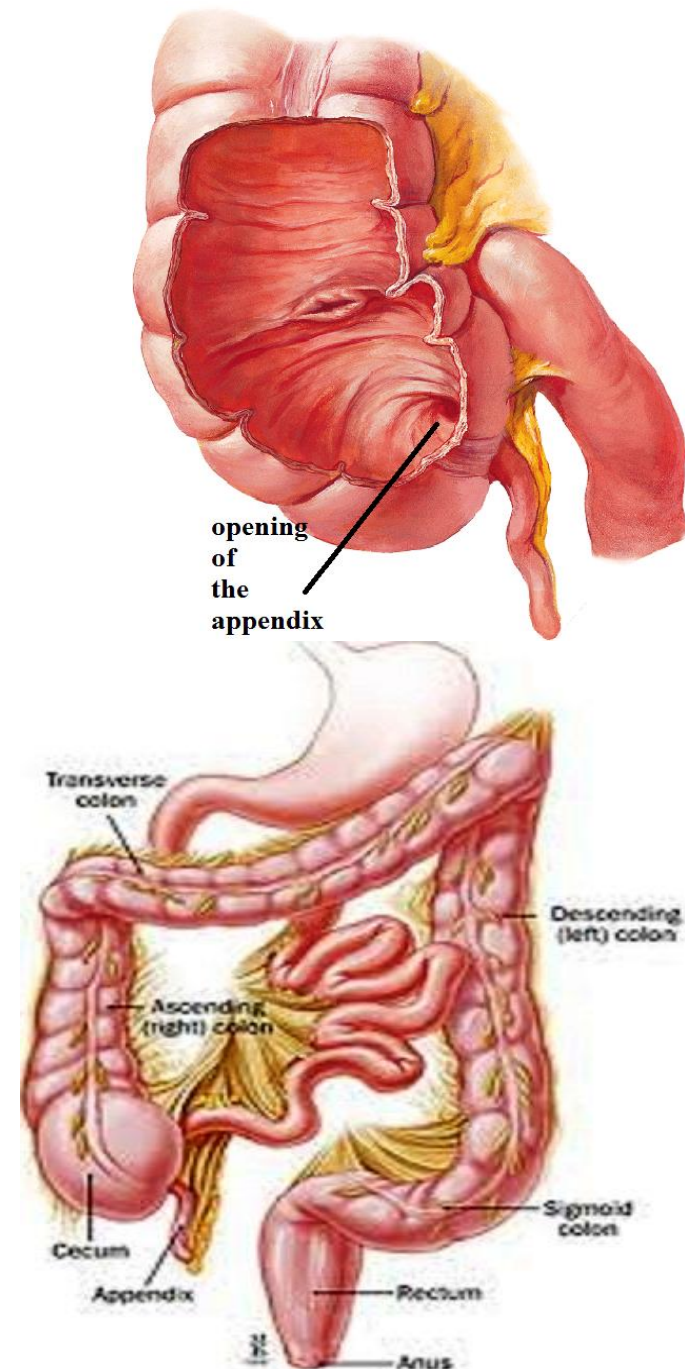
from apex of caecum to
its posteromedial wall
by differential growth

- **Fixation of intestine:**

- The mesentery of duodenum,
ascending colon and descending colon
fuse with peritoneum of post. abd wall &
these organs become retroperitoneal

- The other mesenteries persist

- **At 2nd month** the vitelline duct
is obliterated ,
fibrosed and degenerate



MIDGUT

Congenital Anomalies: of intestine:

A-of intestinal loop

1- atresia (due to failure of recanalization)

2-stenosis (due to defect in recanalization)

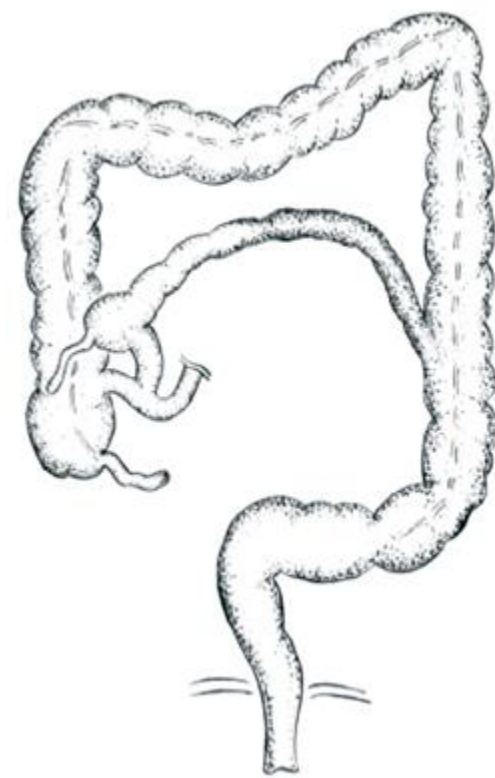
3-Diverticulosis:- due to weak wall

4-Duplication is common in **ileum**

B- congenital umbilical hernia (omphalocele)

-herniation of intestinal loop into umbilical cord

-due to failure of return of
physiological umbilical hernia
or wide umbilical orifice



MIDGUT

Congenital Anomalies:

of intestine:

C- of rotation:

1- excessive rotation more than 270

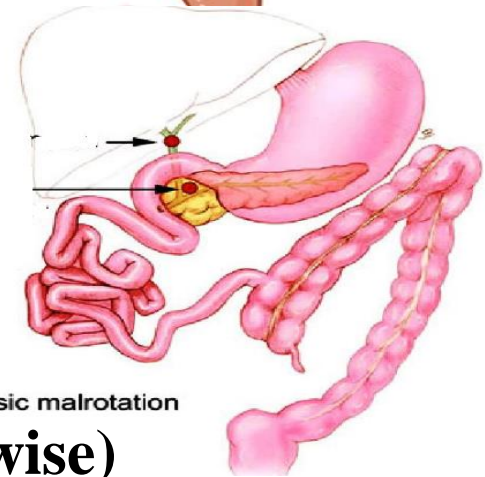
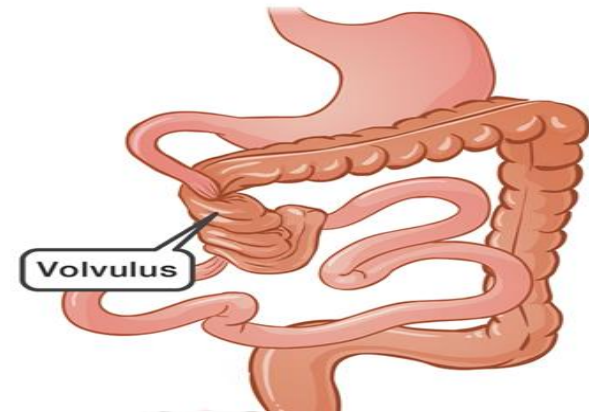
leads to congenital volvulus

2-incomplete rotation 90 anticlockwise only:

caecum & colon become in Lt side of abdomen while duodenum , jejunum and ileum become in Rt side

3-reversed rotation, 90 in reverse direction (clockwise)

duodenum lies in front transverse colon



MIDGUT

Congenital Anomalies: of intestine:

D- of vitelline duct

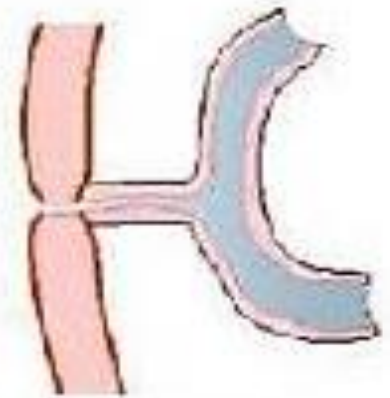
1- vitelline (umbilical faecal) fistula:

- due to persistence of vitelline duct
- with faecal discharge at the umbilicus

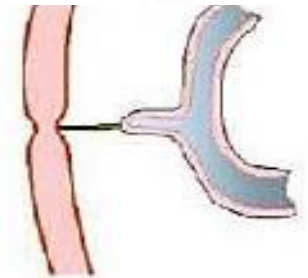
2- Meckel's diverticulum:

- due to persistence of the proximal part of vitelline duct
- it has the following features:

- in 2% of people , 2 inches (5 Cm) long ,2 feet from ileocaecal valve
- Attach to ant mesenteric border of ileum
- Attached to umbilicus by a fibrous cord
- May contain ectopic gastric or pancreatic tissue
- May cause pain confused with the pain from appendicitis



Vitelline fistula



Meckel's diverticulum

MIDGUT

Congenital Anomalies:

of intestine:

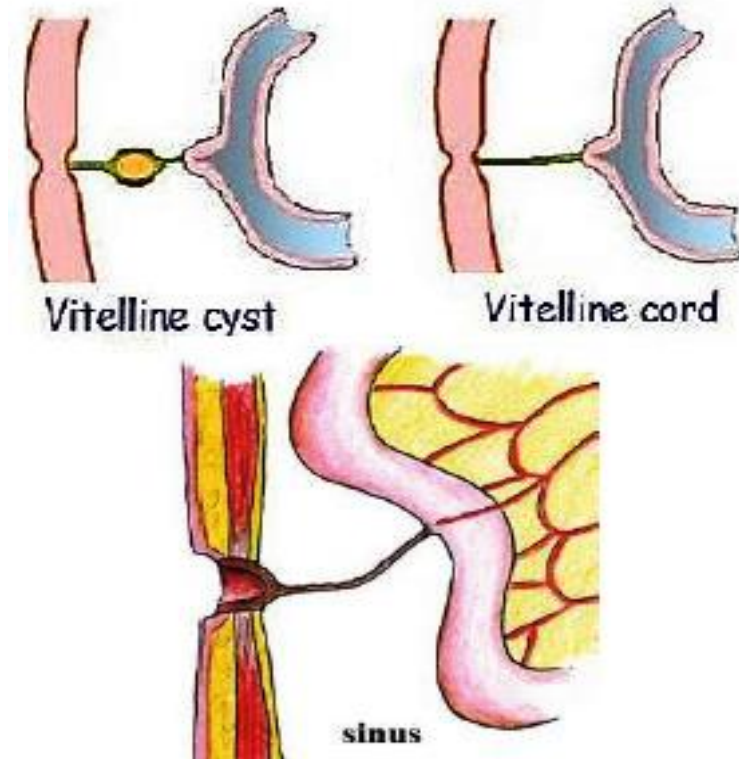
D- of vitelline duct

3-vitelline sinus: due to persistence of distal part of vitelline duct

4-vitelline cyst: due to persistence of middle part of vitelline duct

5-fibrous cord:

- due to failure of degeneration of the obliterated, fibrosed vitelline duct
- a loop of intestine may become wrapped around it causing intestinal obstruction



MIDGUT

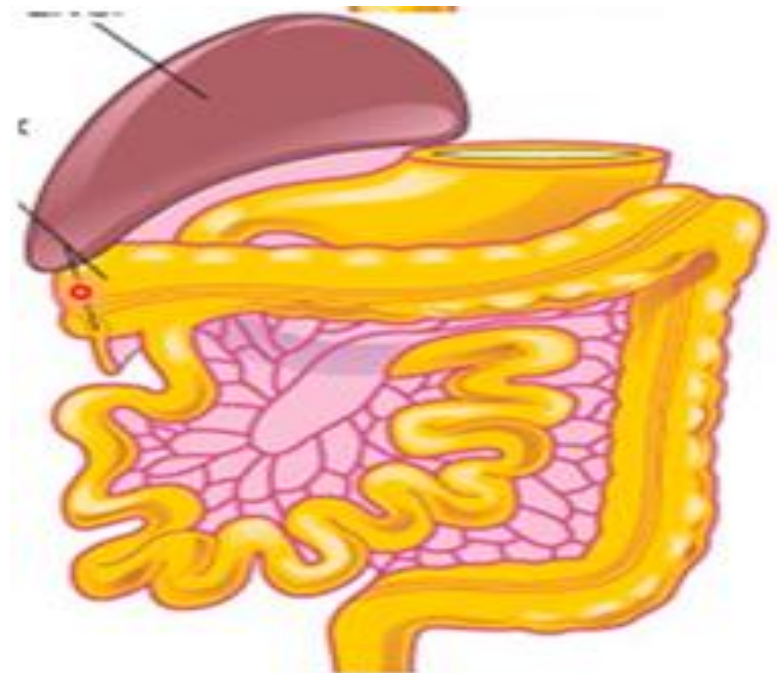
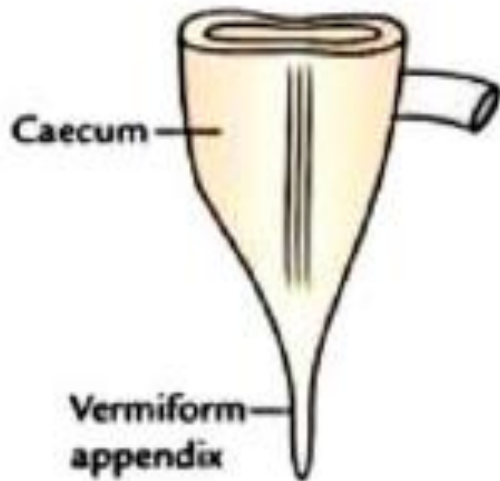
Congenital Anomalies: of caecum and appendix:

1- Abnormal position:

e.g. sub hepatic, or Rt lumbar caecum and appendix:

Due to failure of descend or arrest during descend

2- Retention of fetal shape with apical appendix.



HINDGUT

DEF.:-

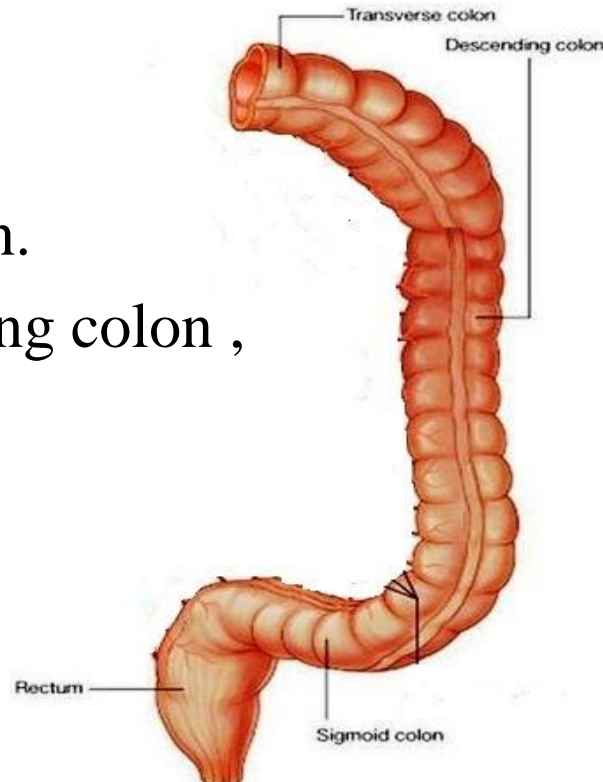
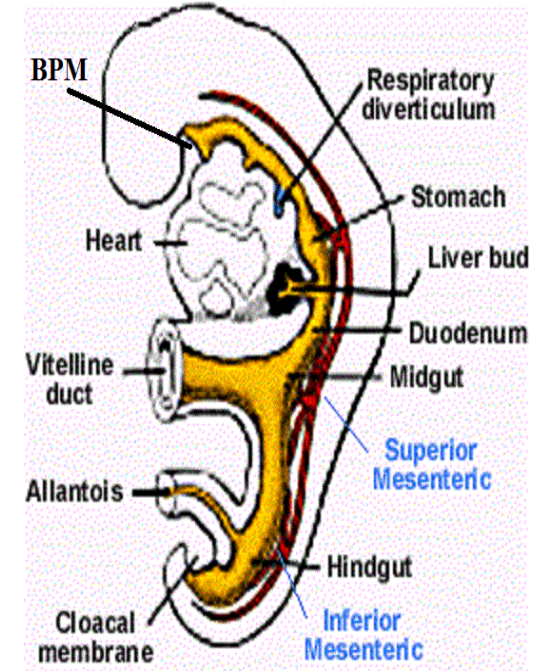
the part of the primitive gut which is enclosed in the tail fold of the embryo.

Extent:

It extends from the posterior intestinal portal until the cloacal membrane.

Fate(derivatives):

- left 1/ 3 of transverse colon.
- left colic flexure, descending colon , sigmoid colon, rectum.
- upper 1 /2 of anal canal.



RECTUM

Development source:

endodermal cloaca of hindgut.

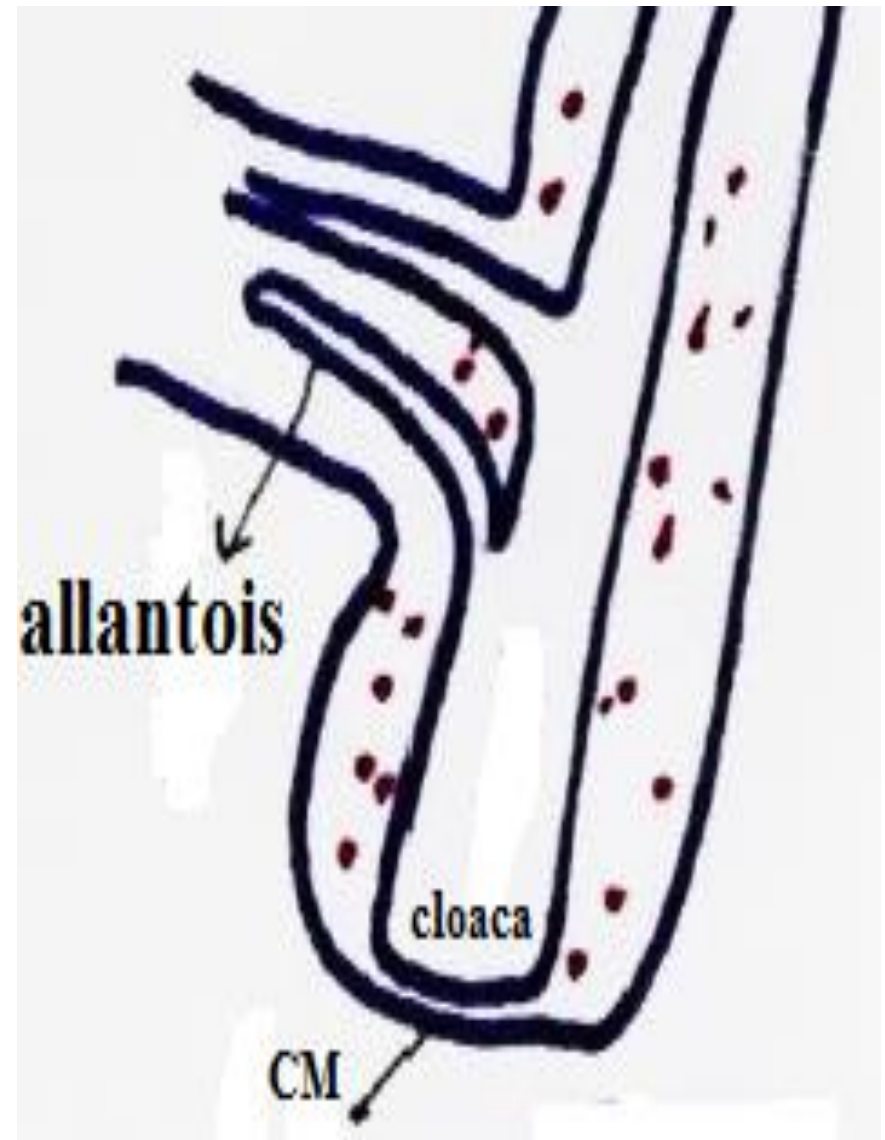
allantois:

diverticulum projecting ventrally from hindgut into umbilical cord

endodermal cloaca:

dilatation in hindgut just distal to origin of allantois, closed caudally by cloacal membrane

(that separate the cavity of hind gut from the surface)



RECTUM

Development:

□ the mesoderm at the angle () hindgut and allantois proliferate and invaginate the endoderm forming urorectal septum that grows inferiorly in a coronal plane dividing the endodermal cloaca into:

-primitive recto anal canal (dorsal)

Form rectum

upper part of anal canal.

-primitive urogenital sinus (ventral)

Form urinary bladder & urethra

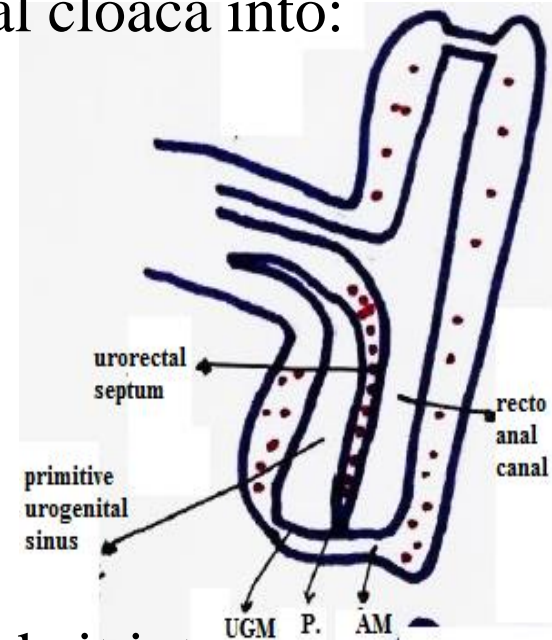
vagina.

□ when septum fuse with cloacal membrane, it divide it into

-anal membrane (dorsal) -urogenital membrane (ventral)

primitive perineum (at site of fusion)

□ the muscle of rectum develop from surrounding mesoderm



ANAL CANAL

Development:

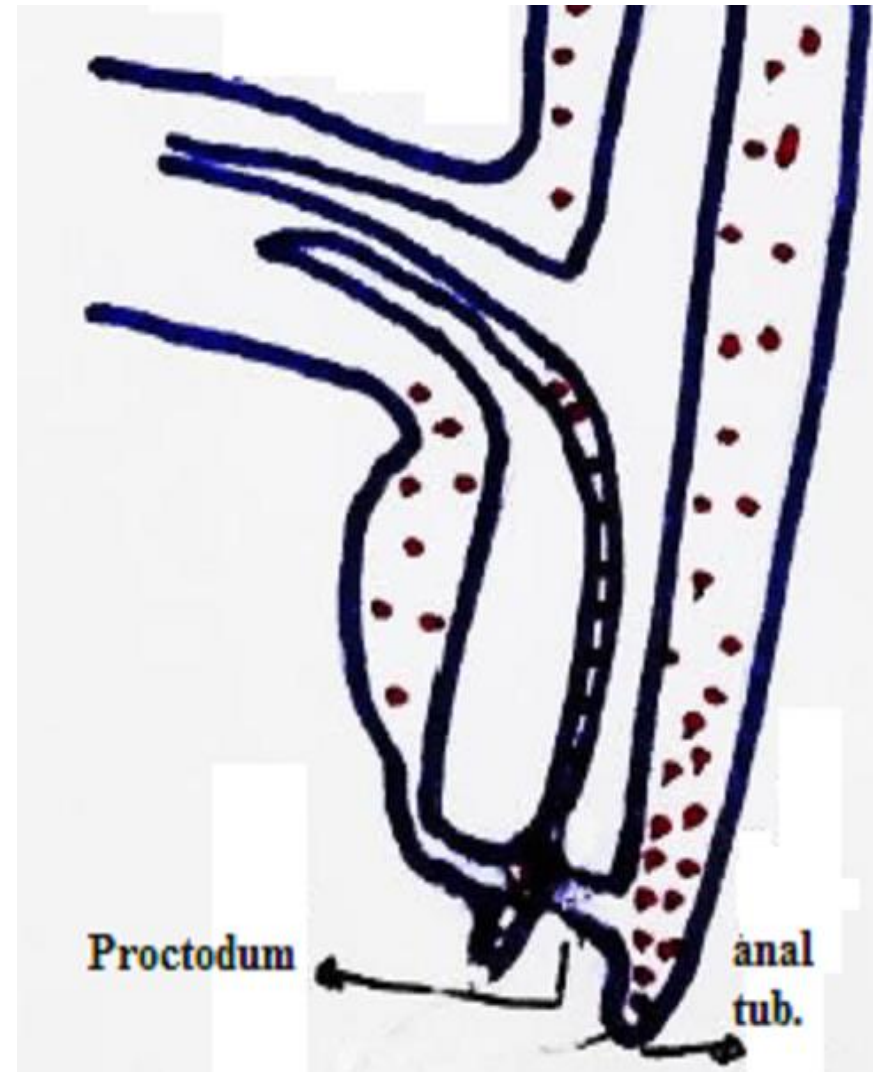
□ **upper half:** from rectoanal canal (endodermal)

This part of anal canal is lined by a mucous membrane.

□ **lower half:** from proctodeum (ectodermal) as follows:

mesoderm around anal membrane proliferate to form anal tubercles, and by the 9th week of development, the anal membrane comes to lie at the bottom of a depression called the proctodeum.

This part of anal canal is lined by stratified squamous epithelium (skin).



ANAL CANAL

Development:

□ rupture of anal membrane

results in continuity() upper & lower 1/2s

N.B: remnants of anal membrane are represented in adult by anal valves & pectinate line

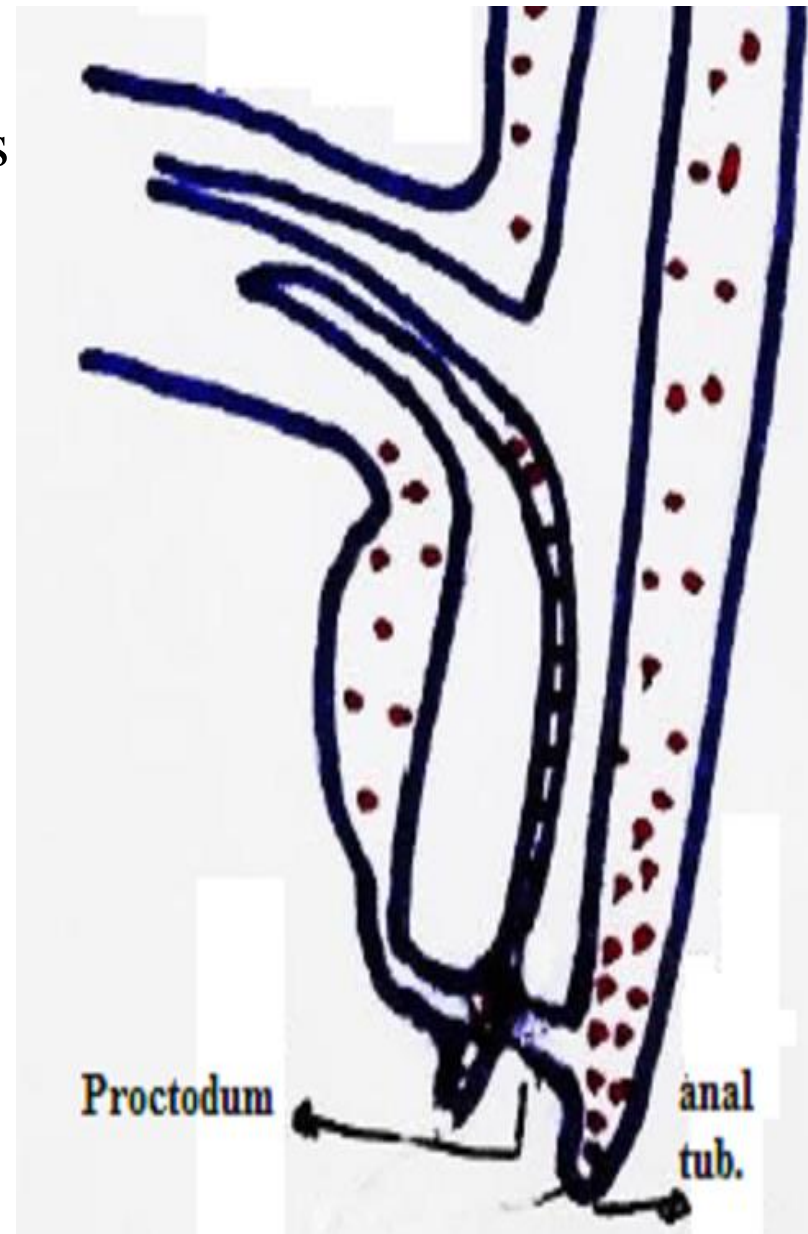
The two parts of anal canal differs in A.S. , N. S.& V.D. , L.D..

□ muscles of anal canal

develop from surrounding mesoderm.

In the upper part form int. anal sphincter (involuntary) , while

In the lower part form ext. anal sphincter (voluntary)



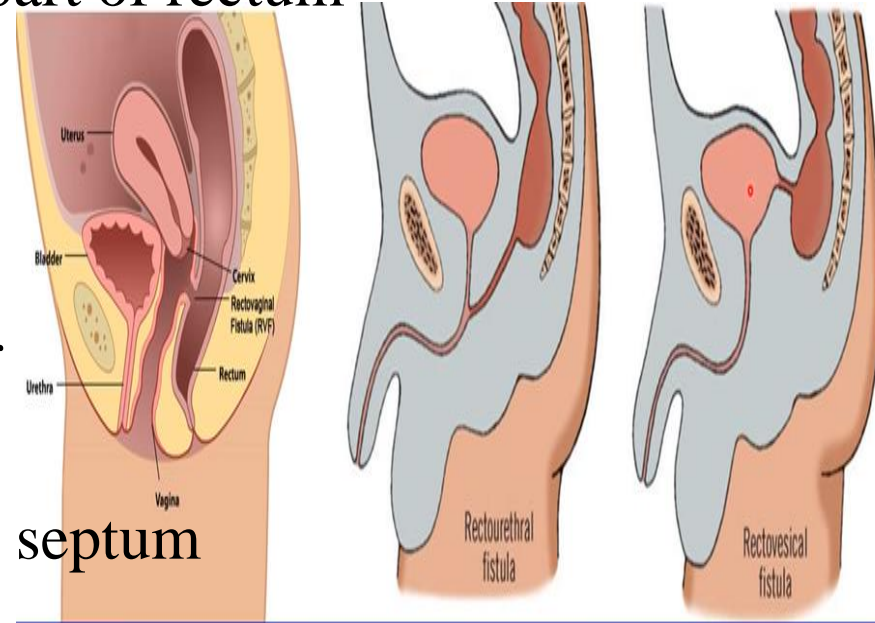
ANAL CANAL

Congenital anomalies of rectum and anal canal:

1-rectal atresia: obliteration of lower part of rectum

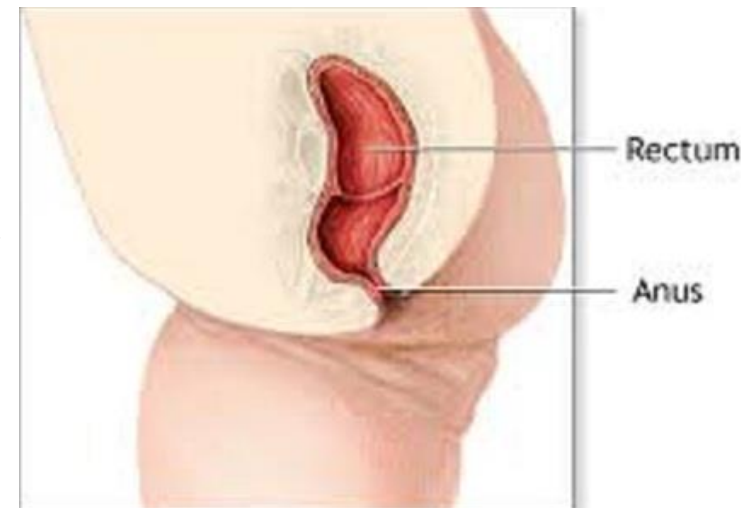
2-rectal fistulae: recto vesical,
recto urethral,
recto vaginal fistulae

- communication () rectum and either the urinary bladder, urethra or vagina
- due to incomplete growth of urorectal septum



3-imperforate anus:

anal membrane fails to rupture
and persist as a diaphragm stretching
across the anal canal at level of anal valves



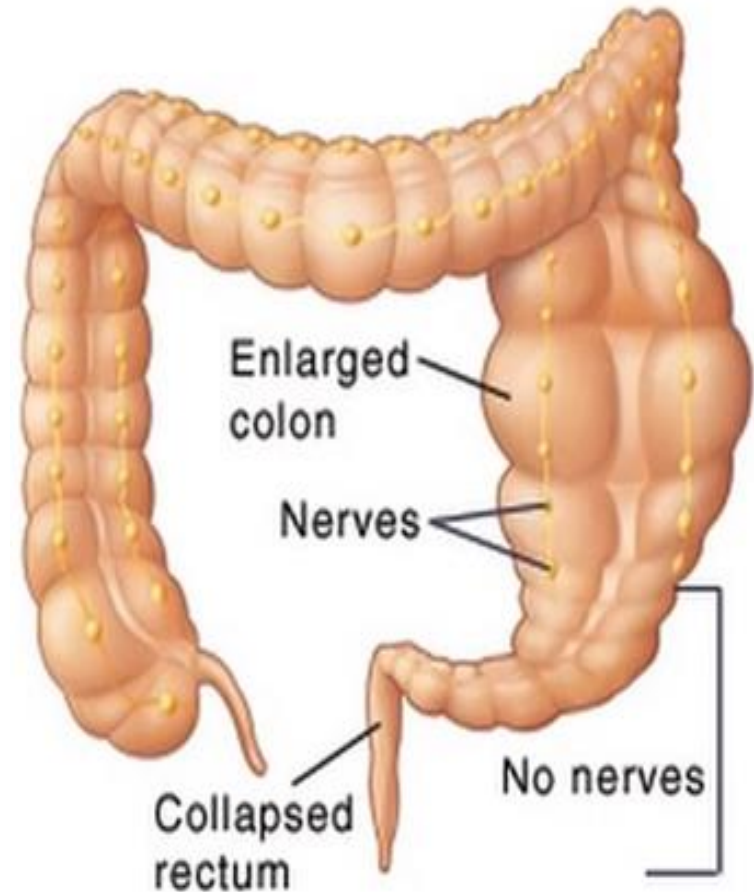
ANAL CANAL

Congenital anomalies of rectum and anal canal:

4-primary megacolon

(Hirschsprung's disease, aganglionic colon)

- in the 1st few days after birth ,
the child fails to pass meconium
and the abdomen become distended
- Rectum & anal canal are constricted
- & sigmoid colon is greatly distended
- Due to failure of migration of
neural crest cells from neural folds
to form parasympathetic ganglia
in wall of bowel



THANQ