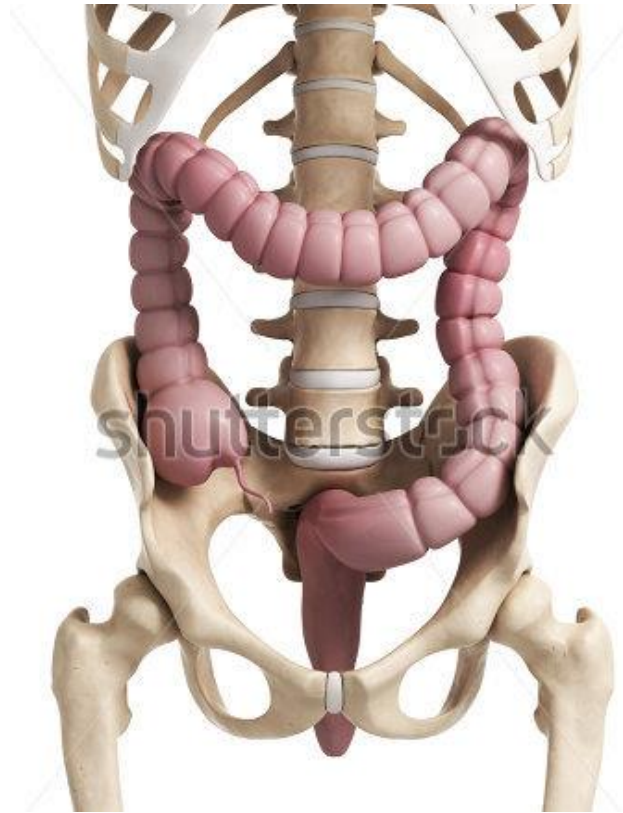


# Morphology and histology of the large intestine and the rectum

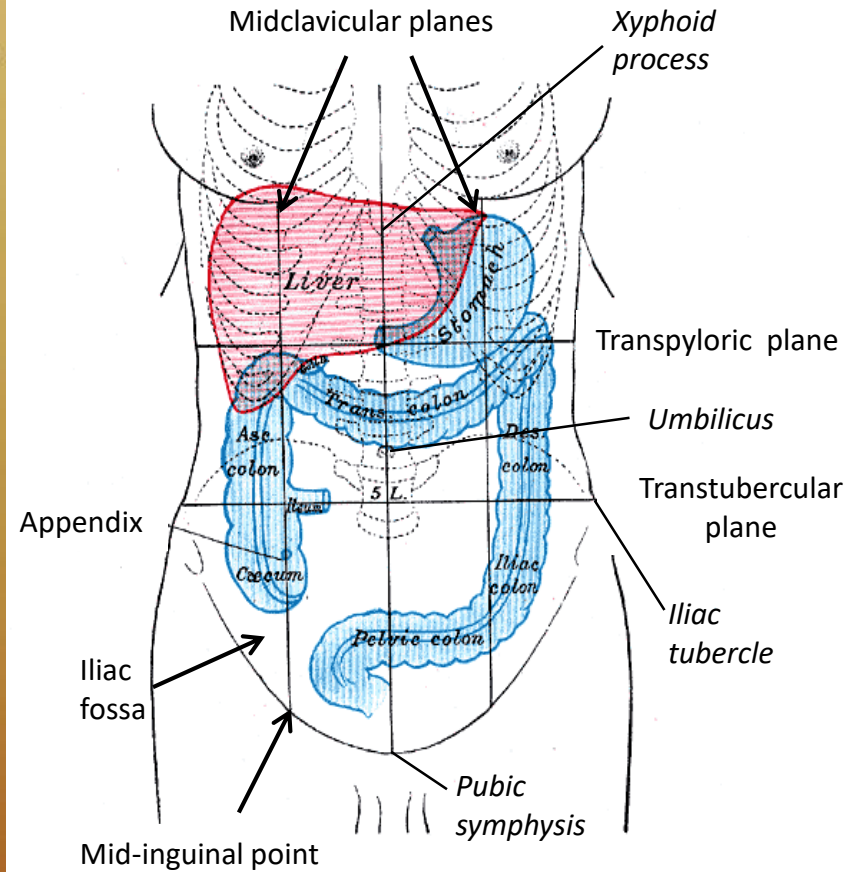
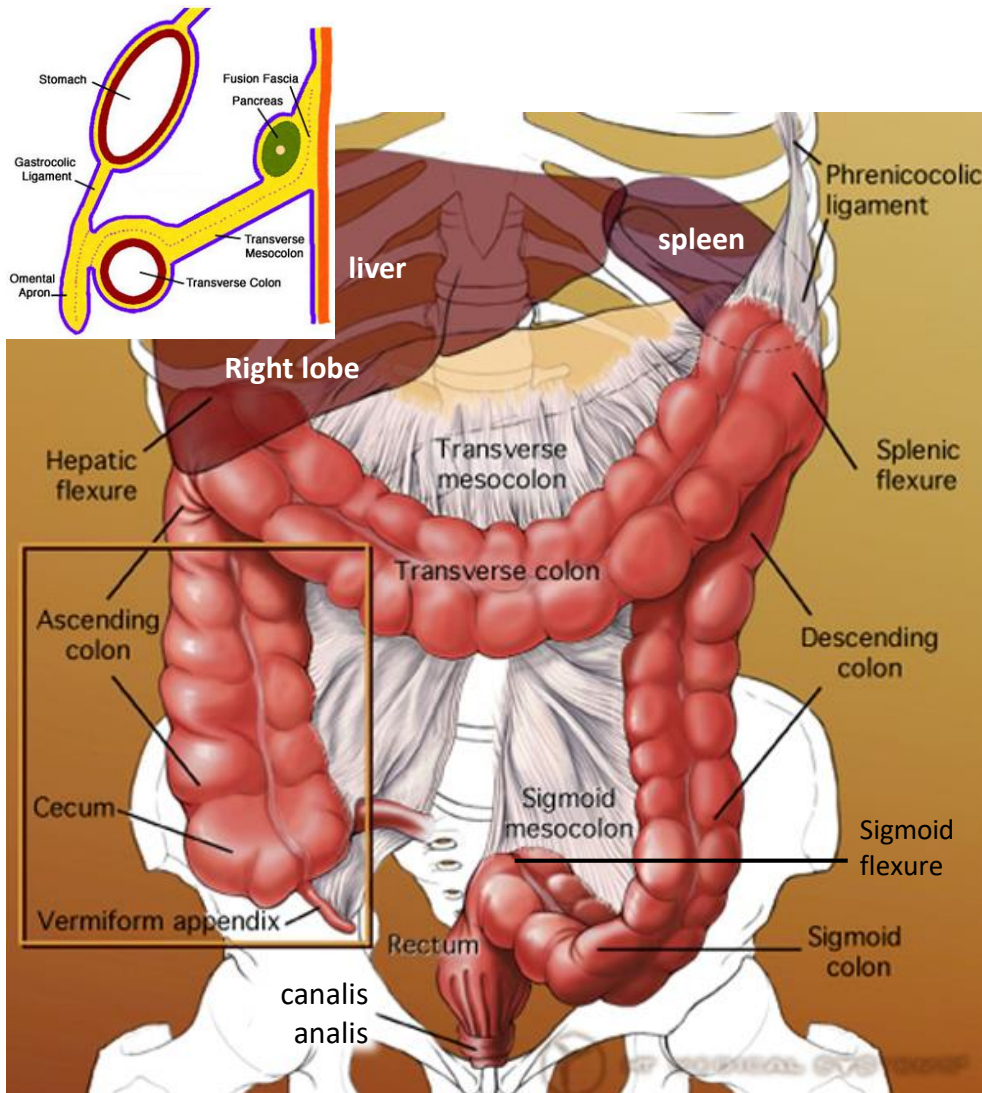


**Dr. Zsuzsanna Tóth**

Semmelweis University

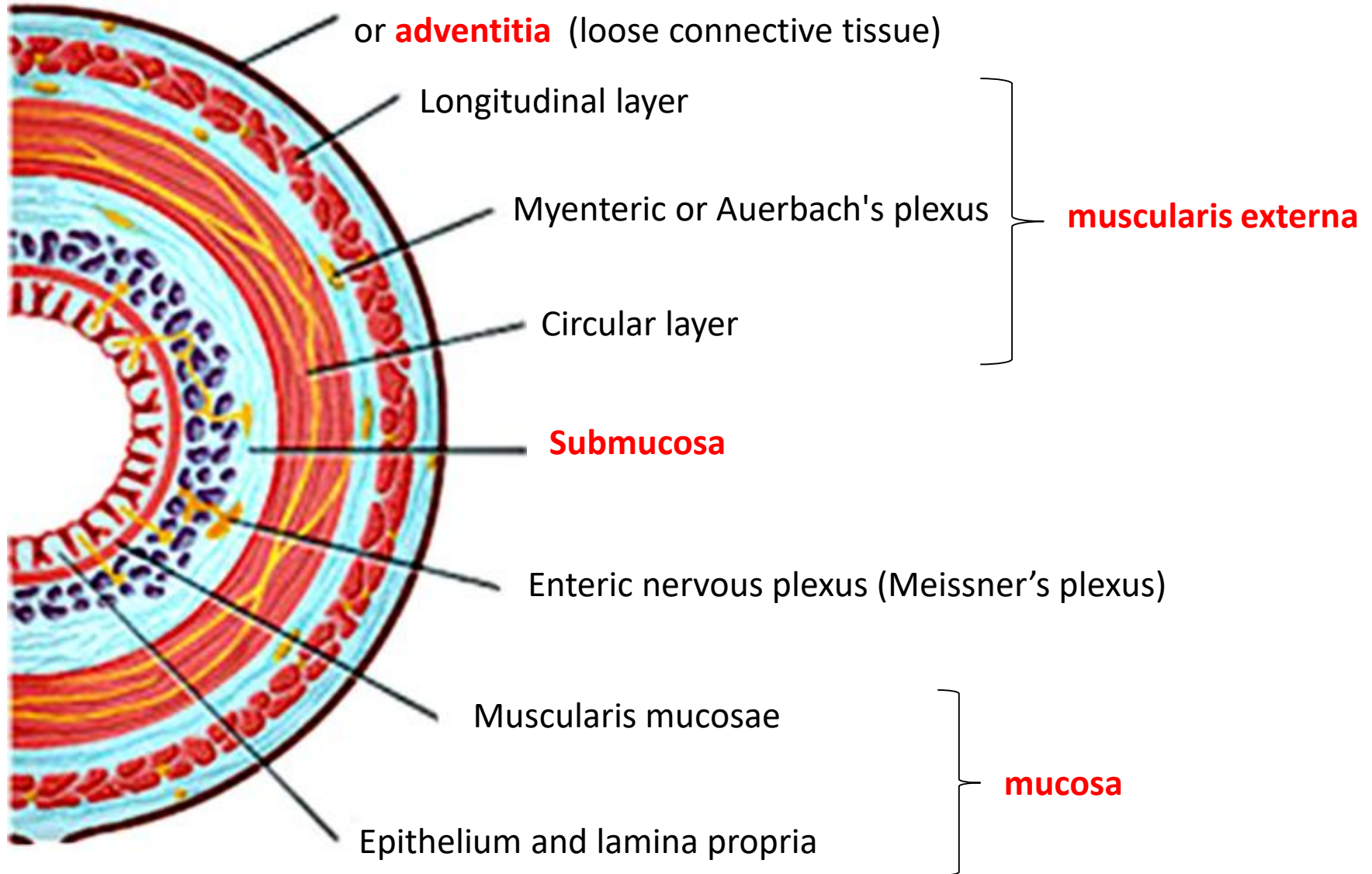
Department of Anatomy, Histology and Embryology

# Morphology of the large intestine



# General histology of the GI tract

**Serosa:** mesothel and **subserosa:** lamina propria, or **adventitia** (loose connective tissue)



# Peritoneum

## Intraperitoneal:

- Cecum - mesocecum
- Appendix - mesoappendix
- Transverse colon – transverse mesocolon
- Sigmoid colon – mesosigmoideum
- Upper 3rd of the rectum - mesorectum (mesorectal fascia)

## Retroperitoneal:

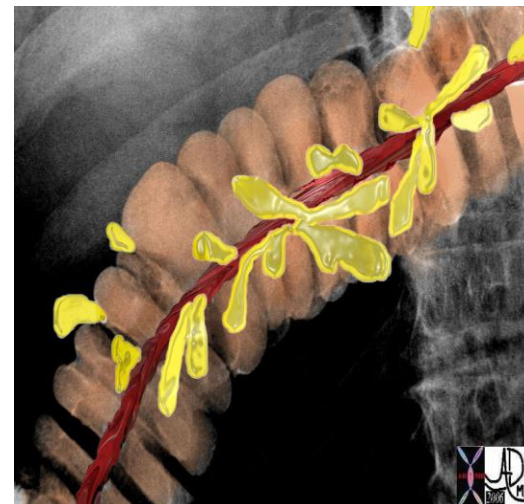
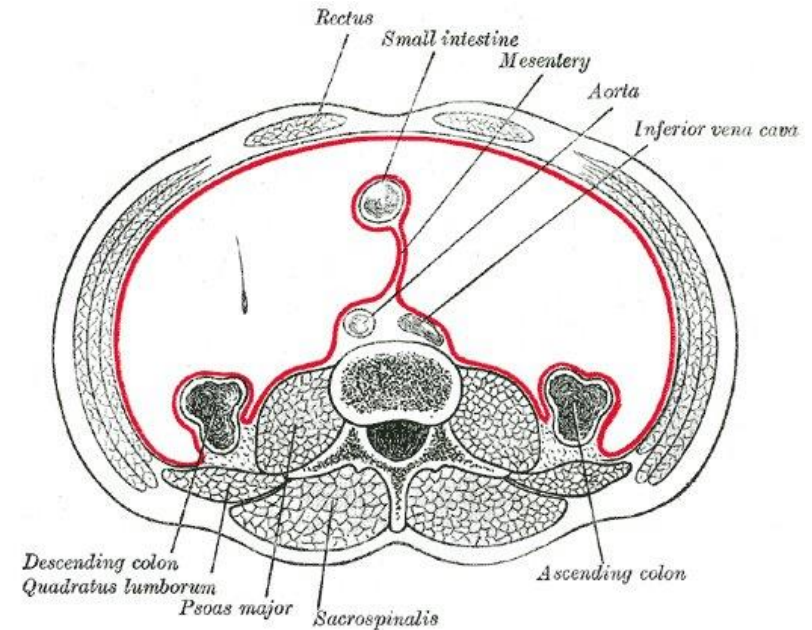
- Ascending and Descending colon
- Posterior surfaces are attached to the abdominal wall
- Middle part of the rectum

## Infraperitoneal

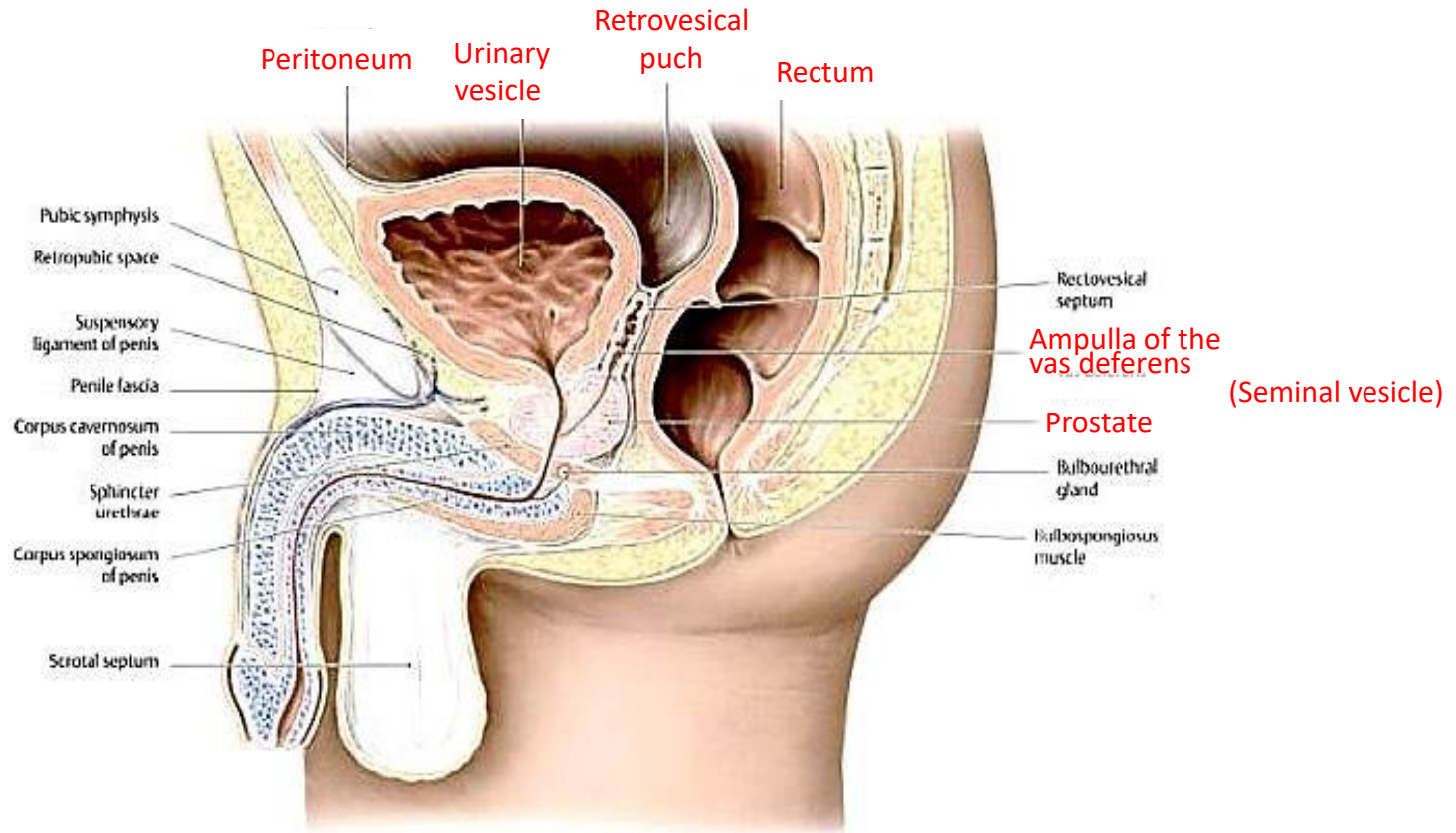
- Rectum- lower parts

## Appendices epiploicae:

- Fat filled pouches
- Specific to the large intestine
- Are formed by the peritoneal coat

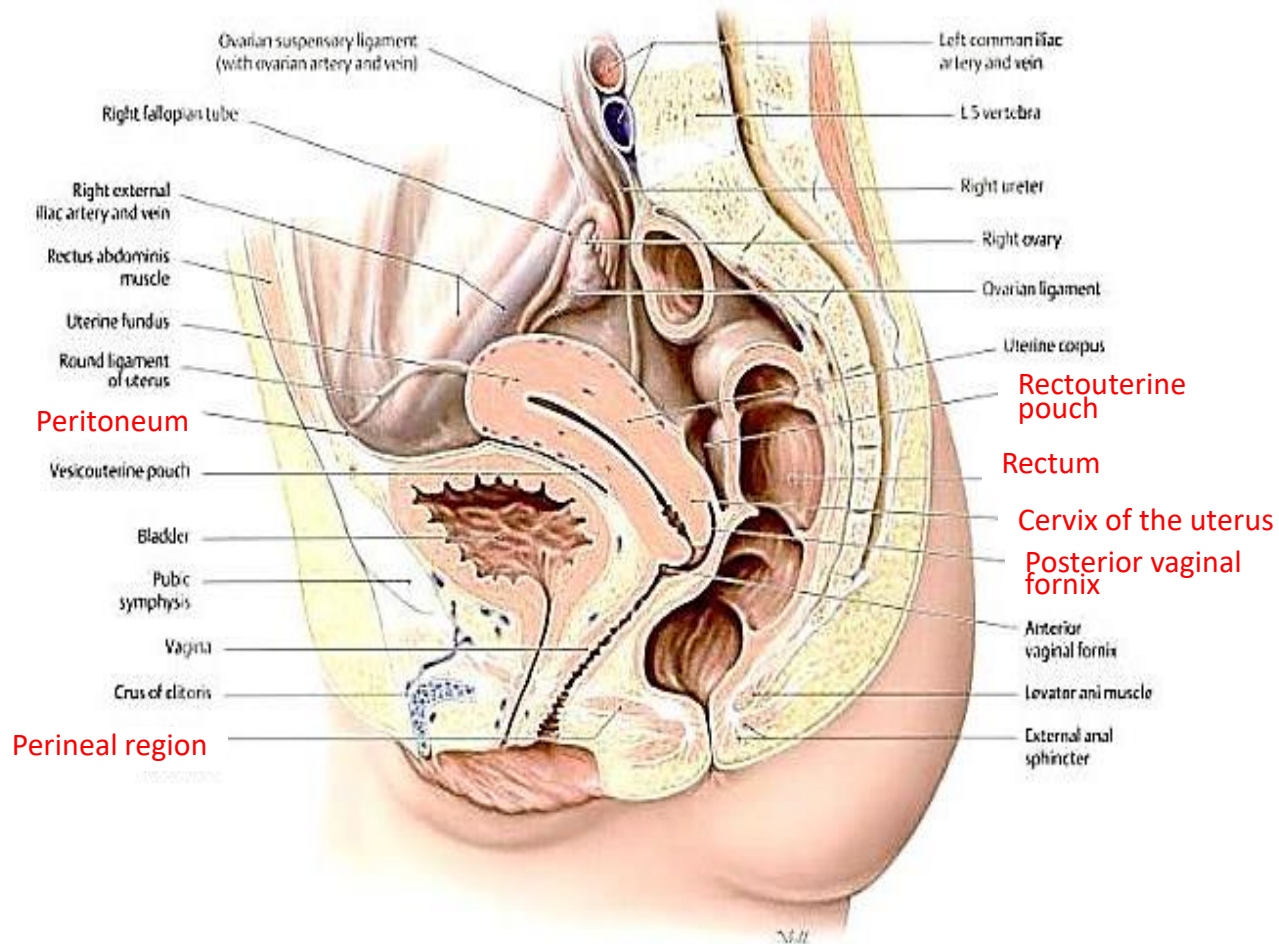


# Frontal section of the pelvic region in men



- **Sacral flexure** - follows the curvature of the sacrum, anteriorly concave
- **Perineal flexure**- follows the curvature of the tail bone, anteriorly convex
- anal canal- closed
- **Rectal ampulla** – dilatated portion, just above the anal canal, develops with age
- **Peritoneum:**
  - Upper third: intraperitoneal
  - Middle:front is covered only
  - Lower third-infraperitoneal
  - Deepest points: excavations or pouches

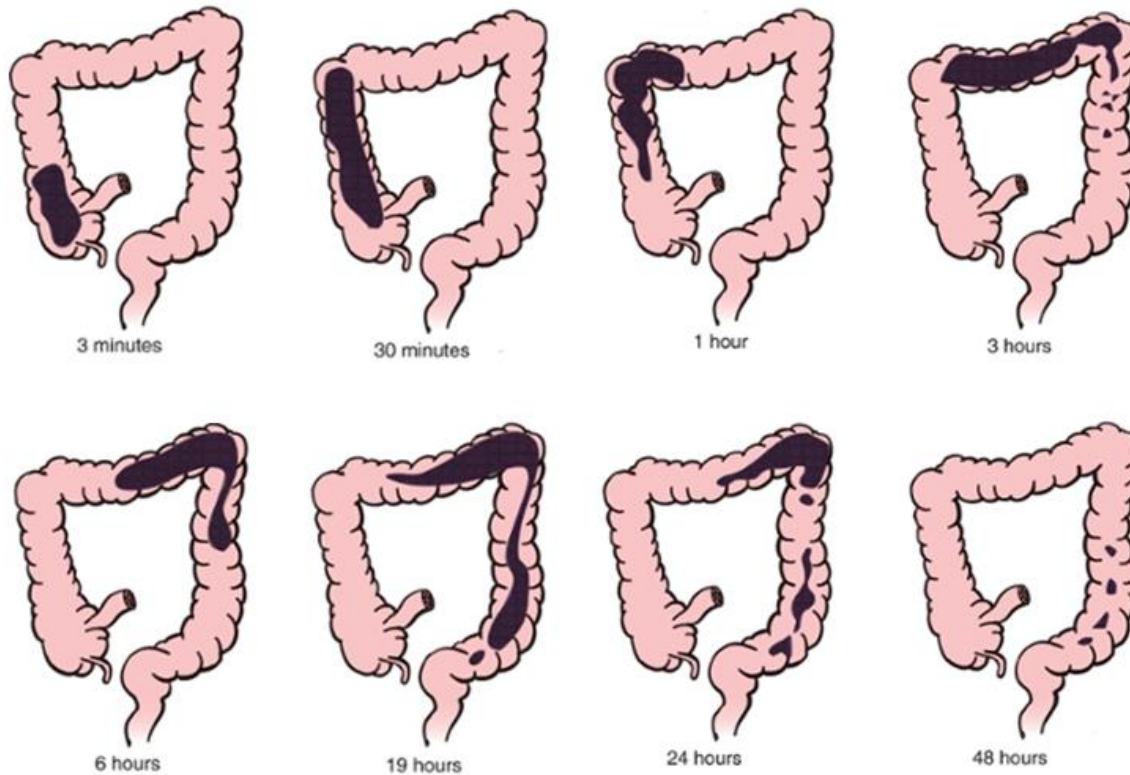
# Frontal section of the pelvic region in women



# Motility of the transverse colon is specialized for storage and removal of water from the feces.

Large intestine general features:

- Slow progression, unpredictable timing
- Contents of different meals are mixed together
- Chyme is more solid



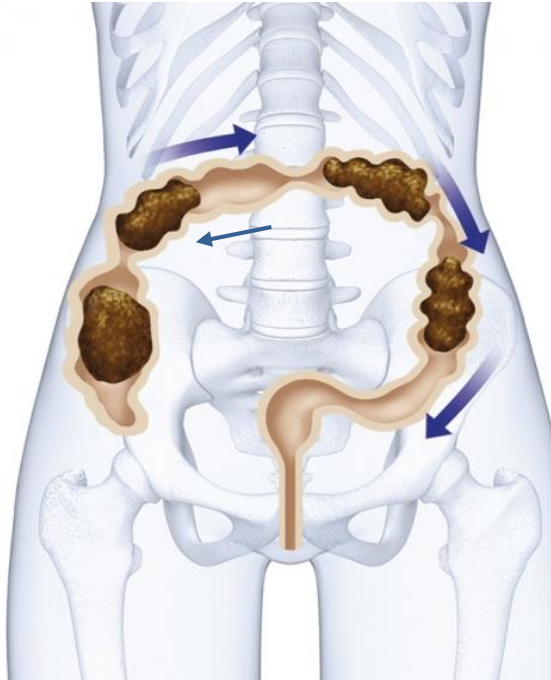
# Large intestinal motility

- Mass movements: 2 -3x per day,
  - extra strong peristaltic movement,
  - starts from the middle of the transverse colon
  - drives faeces into the rectum → triggers defecation reflex

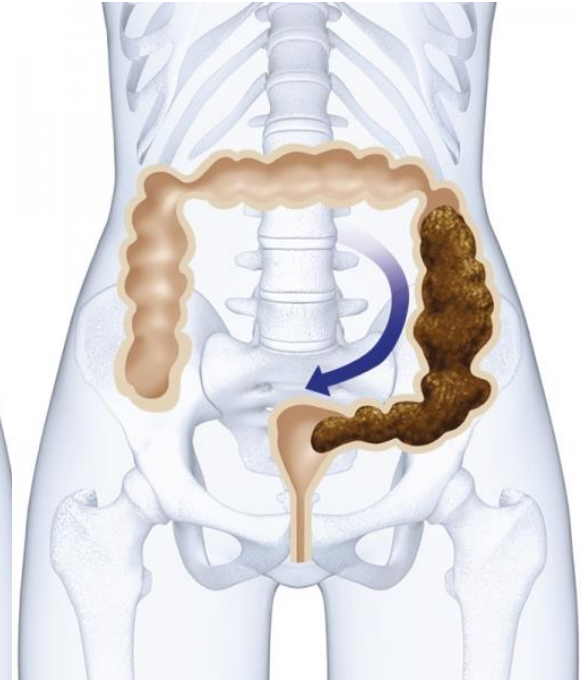
**Segmentations**



**Peristaltic**



**Mass movements**

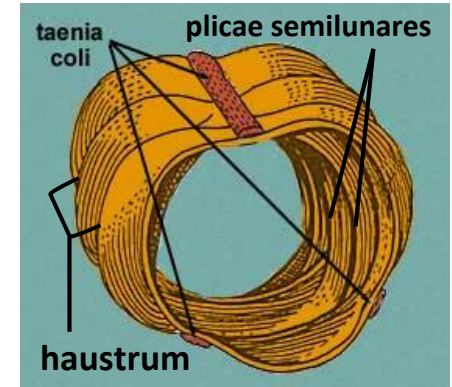
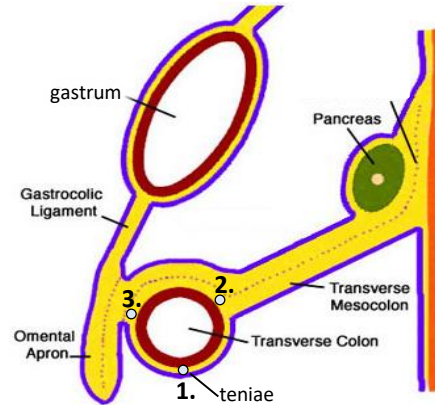




# Muscularis externa

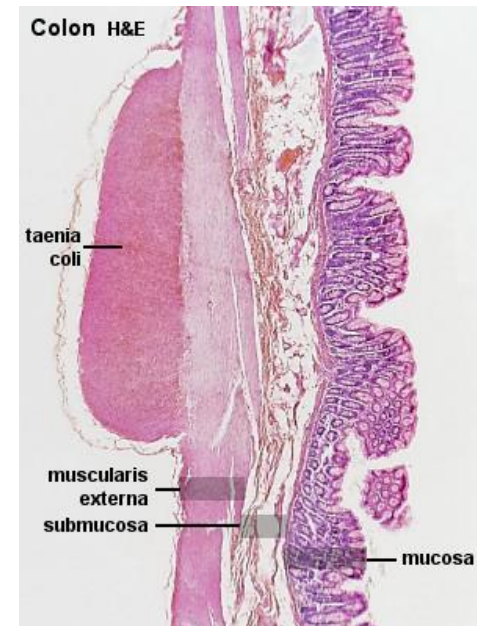
## Longitudinal layer:

- Forms separate longitudinal bands (teniae coli):
  - from the cecum to the sigmoid colon;
  - 1. free, 2. mesocolic, 3. omental teniae
  - converge at the roof of the appendix
  - sigmoid colon: mesocolic and free tenias only
  - appendices epiloicae are attached to them
  - *plicae semilunares*-musosa and submucosa
  - *sacculations-haustra*
  - haustra disappears if theniae are dissected off

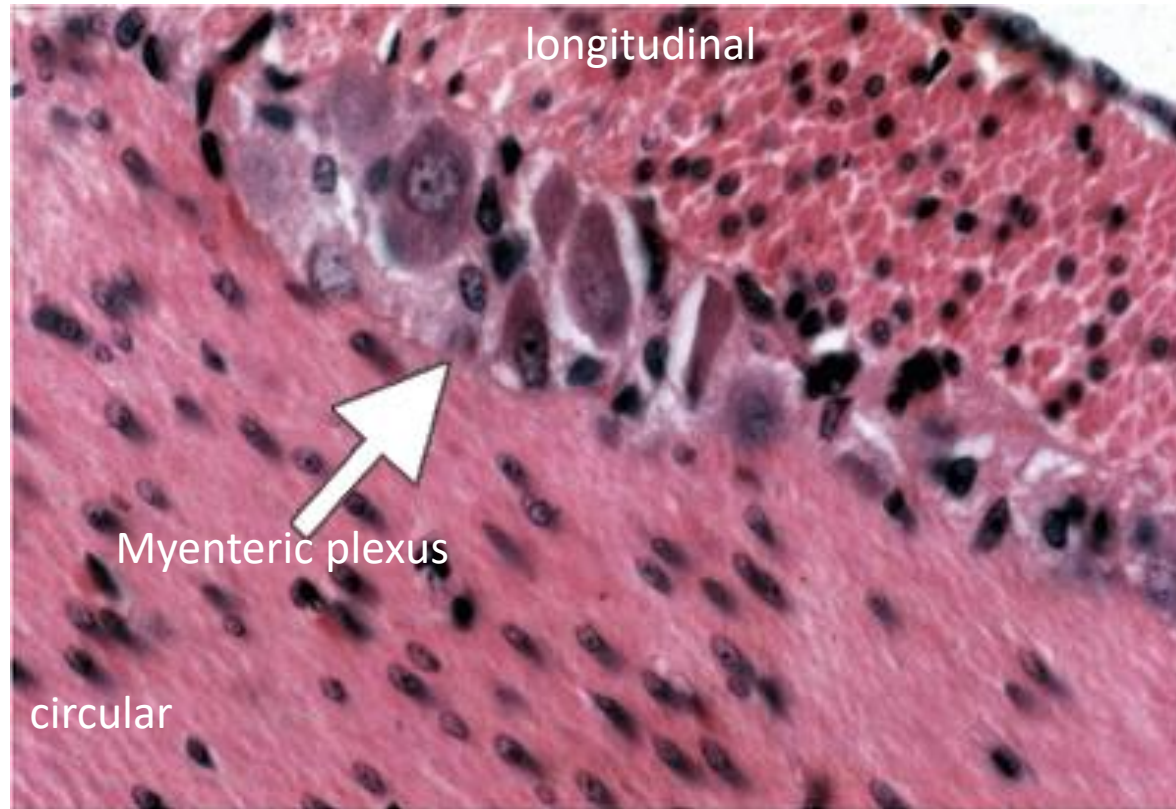


## Circular layer:

- Continuous
- Forms sphincters and valves:
- m. sphincter pylori, m. sphincter ani internus,
- ileocecal valve and sphincter



# Regulation of the intestinal movements



## Primary controll:

- enteral nervous system, myenteric plexus
- esophagus - m. sphincter ani internus
- input: chemo- and mechanoreceptors

## Secondary controll:

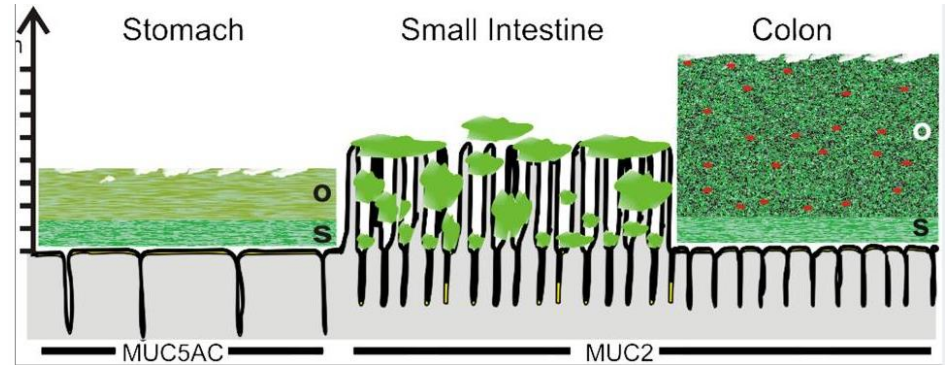
- parasympathetic nervous system (vagal n.) - stimulatory
- sympathetic nervous system - inhibitory
- hormones, digestive enzymes:
  - motilin, CCK, insulin- stimulatory
  - glucagon, opioids- inhibition

# Main functions of the mucosa and submucosa

## 1. Absorbtion:

Water and electrolites /day:

Segmentum	Leaving	Na+	Efficiency %	Efficiency %
	ml	mM	water	Na+
duoednum	9000	800		
jejunum	5000	700	44	13
ileum	1500	200	70	72
<b>colon</b>	<b>100</b>	<b>3</b>	<b>93</b>	<b>99</b>



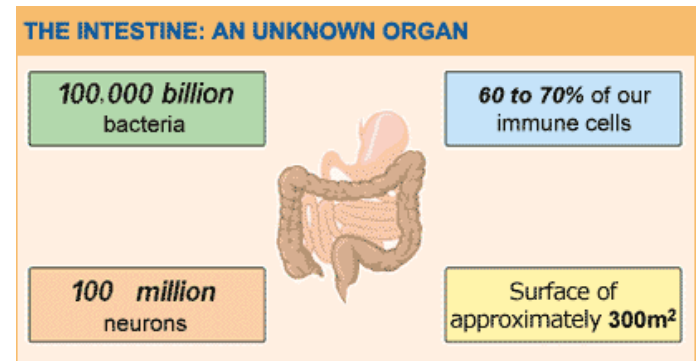
Proc Natl Acad Sci U S A. 2011 Mar 15;108 Suppl 1:4659-65

## 2. Secretion:

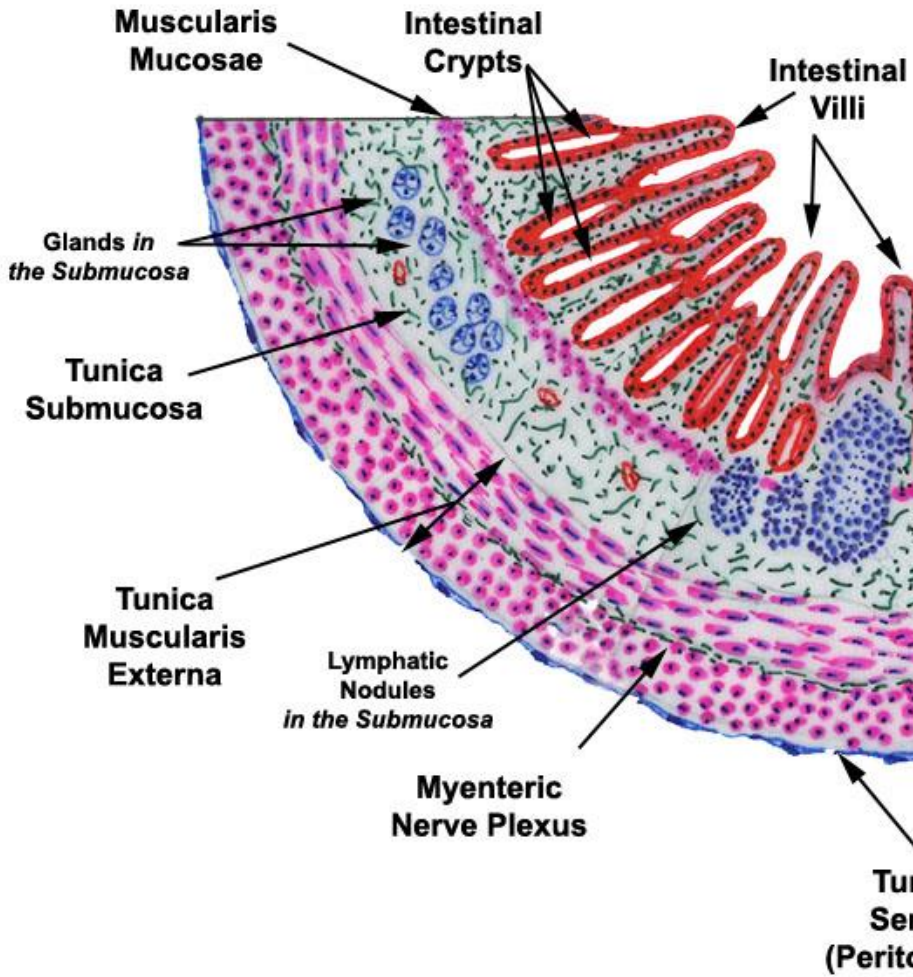
- mucin (mechanical protection, lubrication)
- bicarbonate ions-neutralization (Cl<sup>-</sup> exchange)
- regulation : submucosal plexus, enteroendocrine cells

## 3. Protection-tolerance

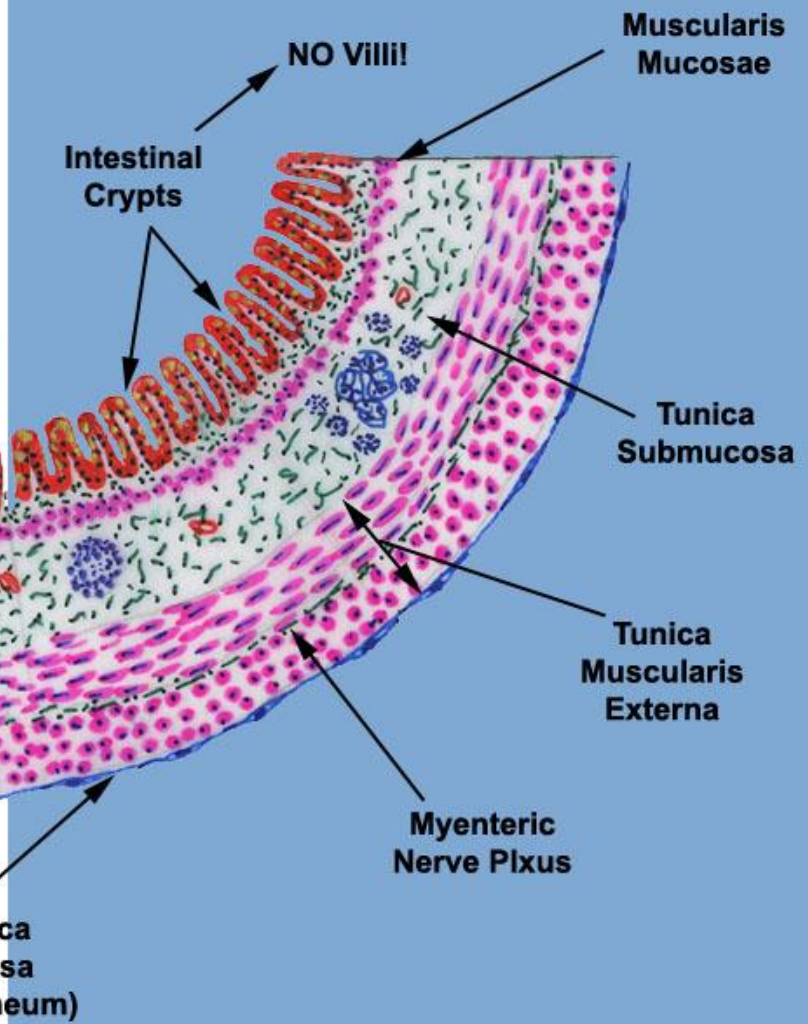
- „oral tolerance”: prevention of food allergies
- protection against pathogens, toxic materials, mechanical injuries
- microflora in the colon
- gastrointestinal barrier function
  - sterile inner mucin layer in the colon, etc.
  - immune system (GALT)



# SMALL INTESTINE



# LARGE INTESTINE

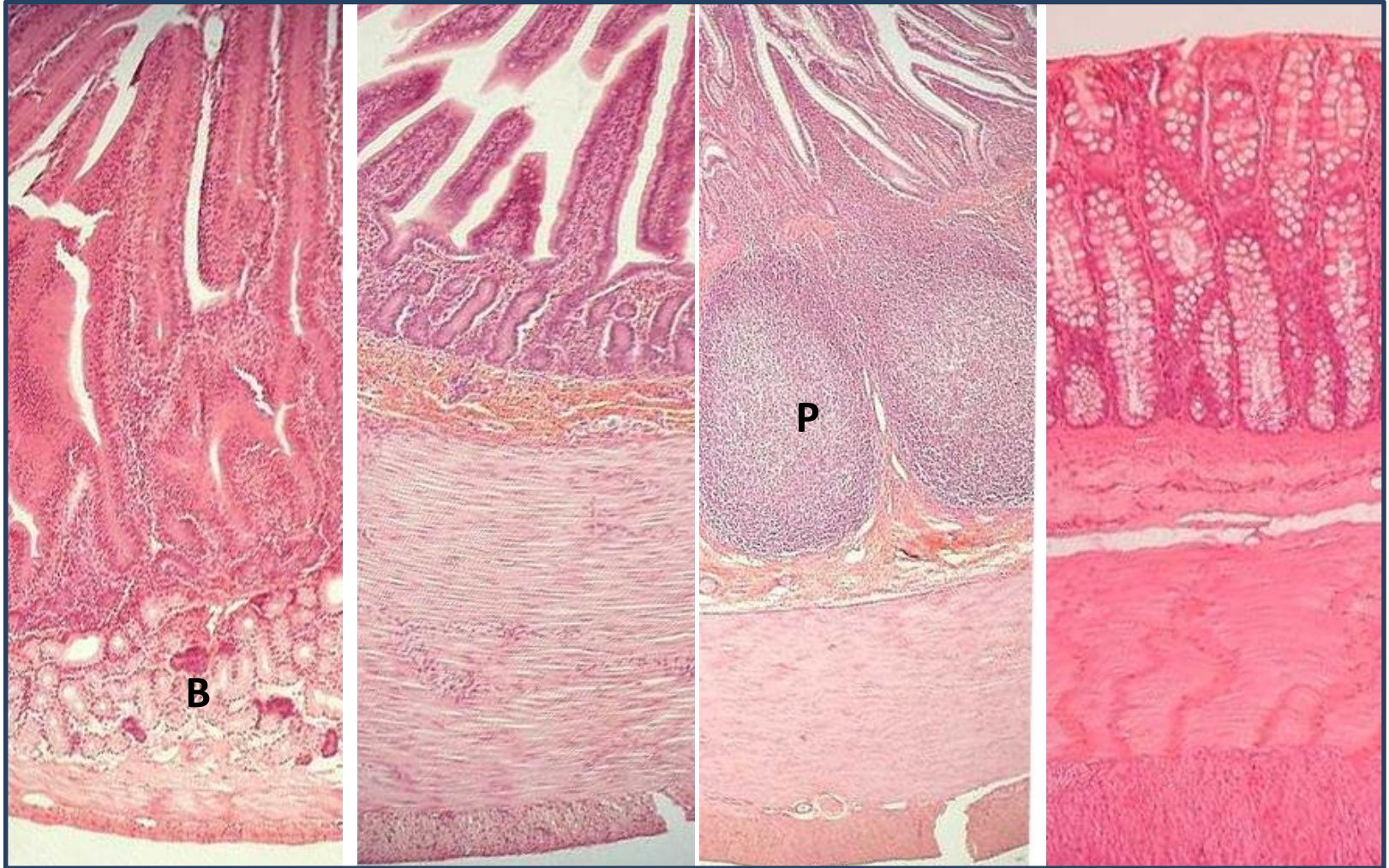


**Duodenum**

**Jejunum**

**Ileum**

**Colon**



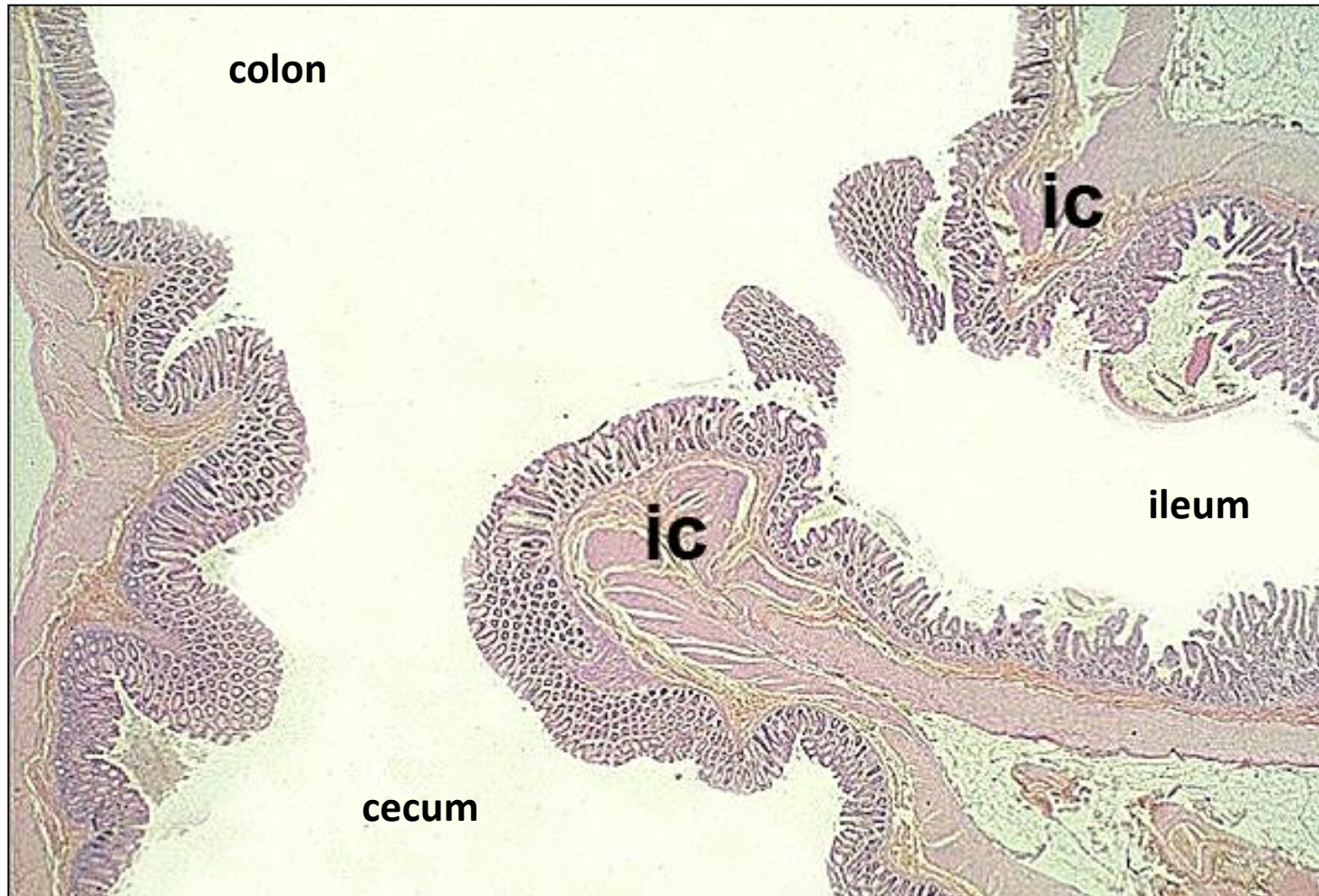
**Mucosa:** Intestinal villi and Lieberkühn crypts (intestinal glands)

no villi, deep crypts

**Submucosa:** Brunner glands

Peyer's patches

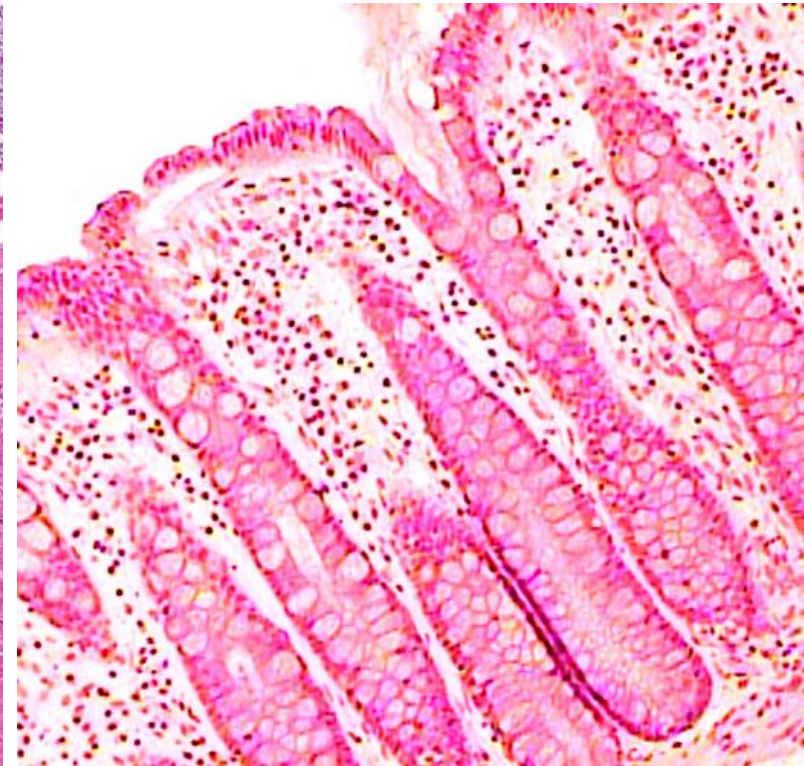
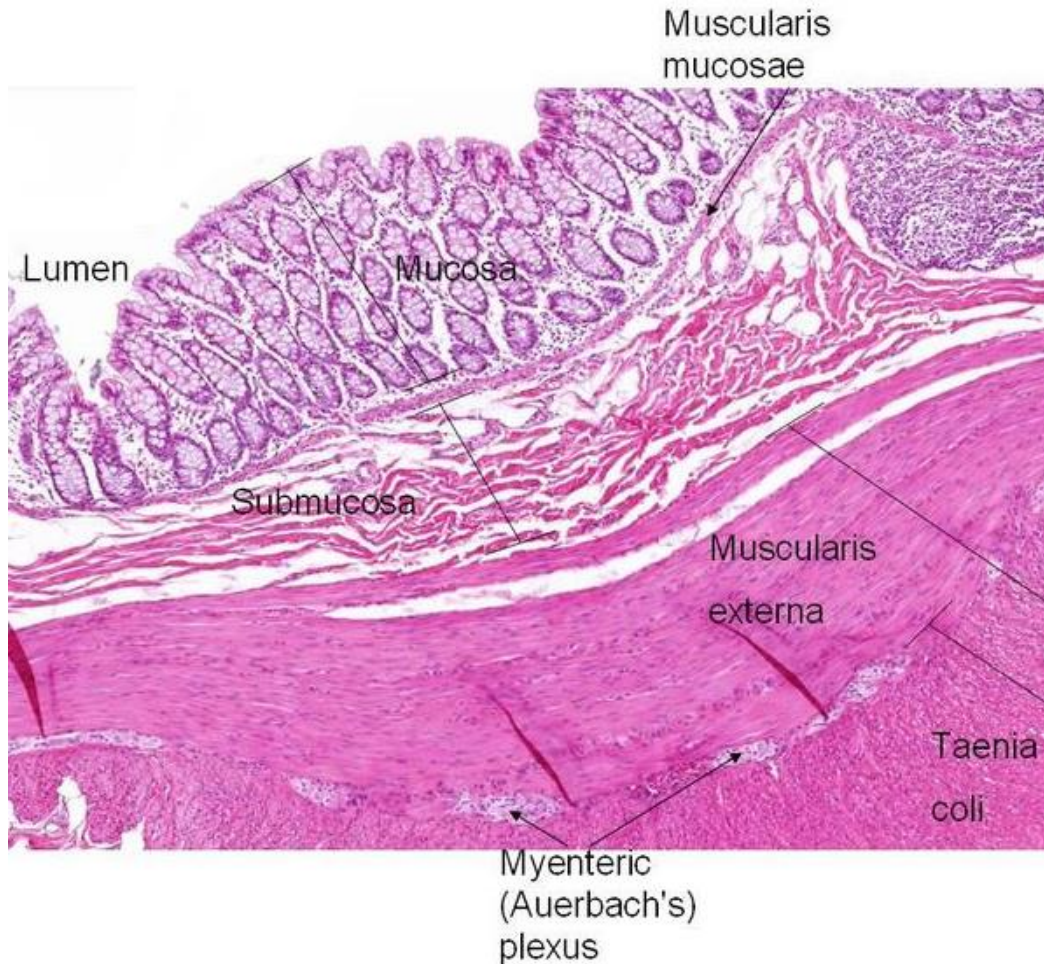
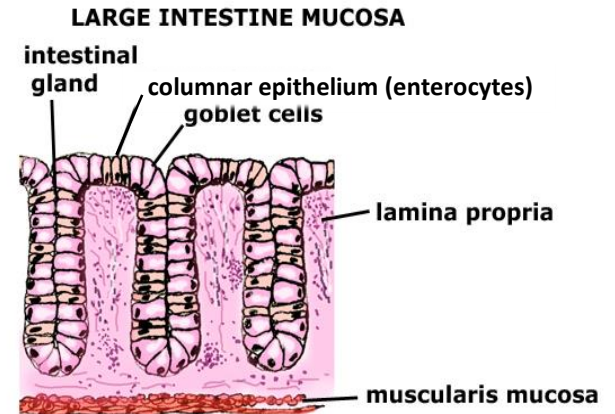
# Ileo-cecal junction



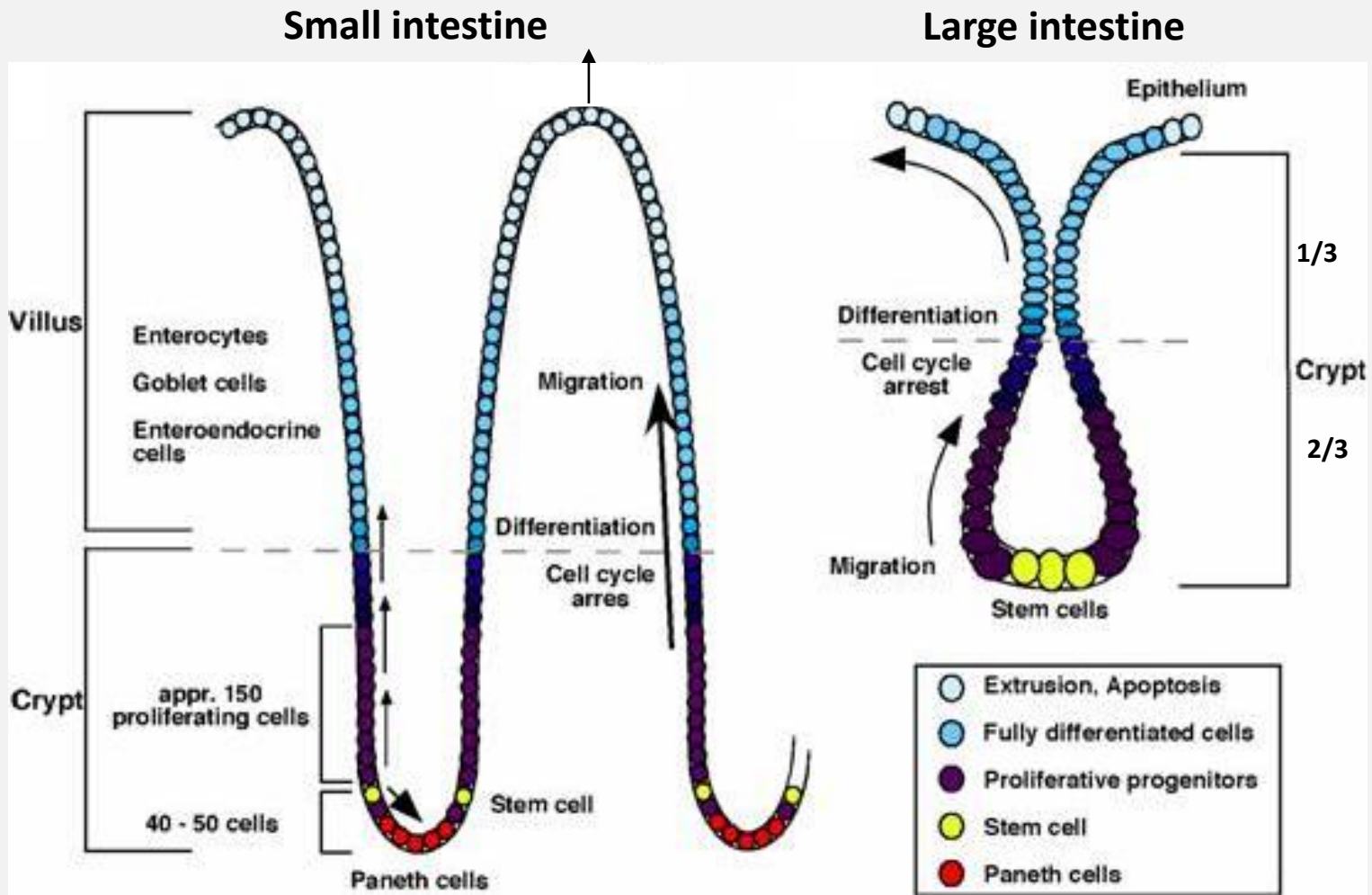
- villi in the ileum
- ileocecal valve (ic) and sphincter – thickening of the internal (circular) muscle layer
- no villi in the large intestine (cecum)

# Histology of the colon

- enterocytes-no digestive enzyme production
- water and electrolite reabsorbtion
- number of goblet cells increases caudally
- deep crypts
- thick mucin layer

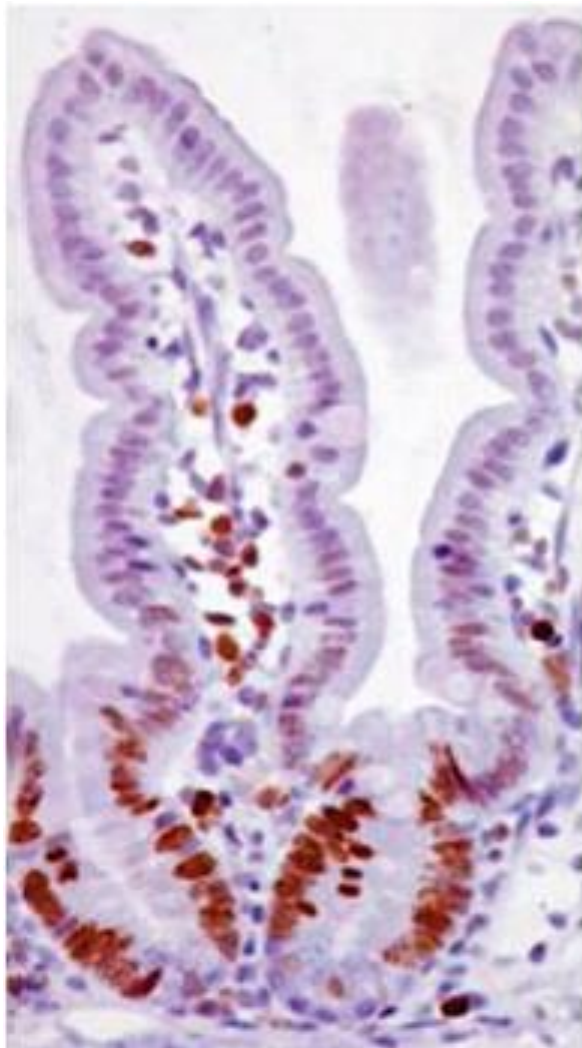


# Cell renewal in the crypts





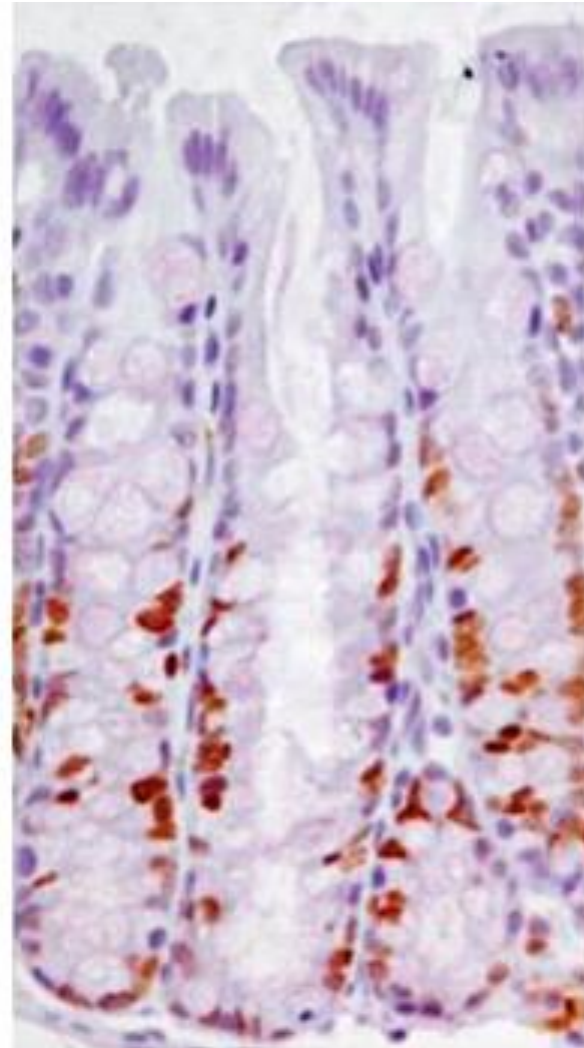
# Visualization of proliferating cells by immunohistochemistry



villus

crypt

**small intestine**



epithelium

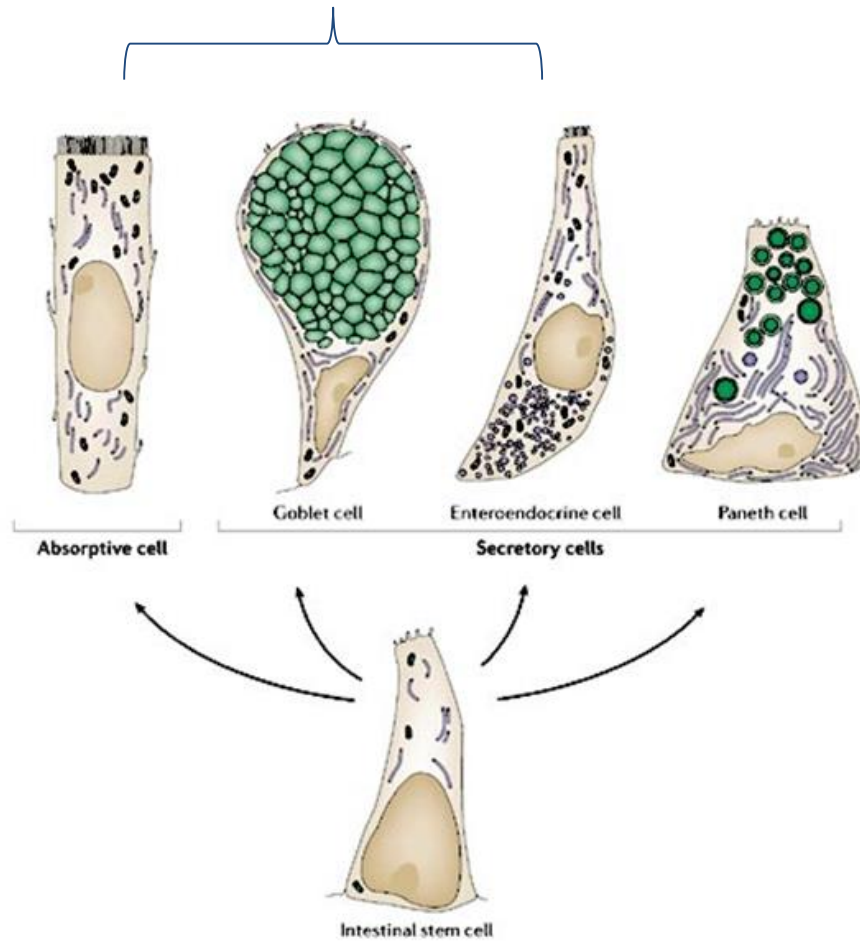
crypt

**large intestine**

Ki67 immunohistochemistry, DAB reaction

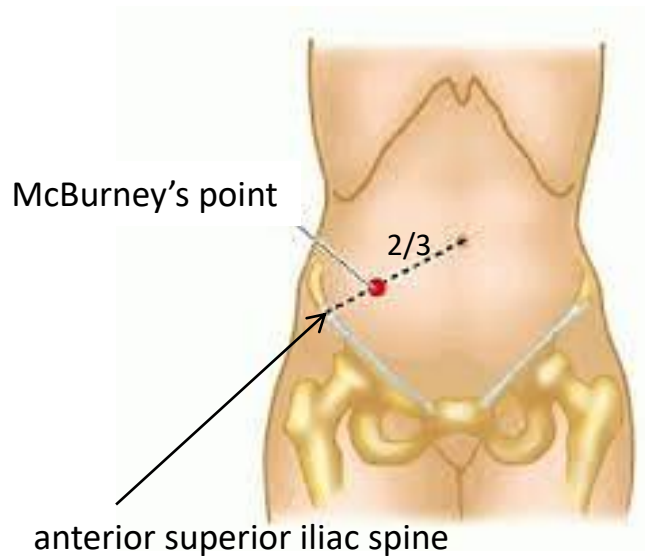
small and large intestine

small intestine



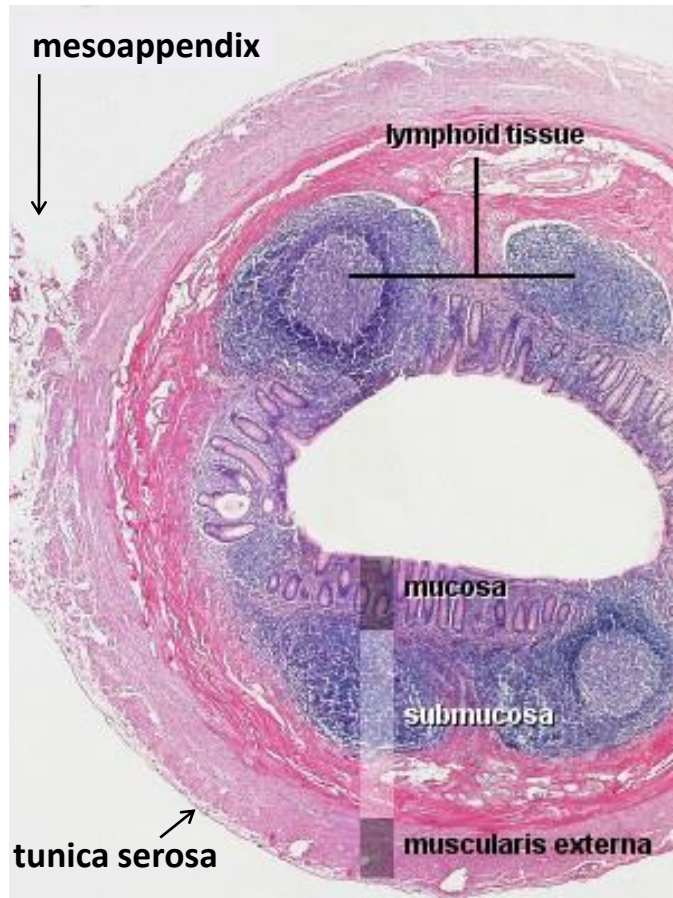
# Vermiform appendix

Variations in positions of the appendix:



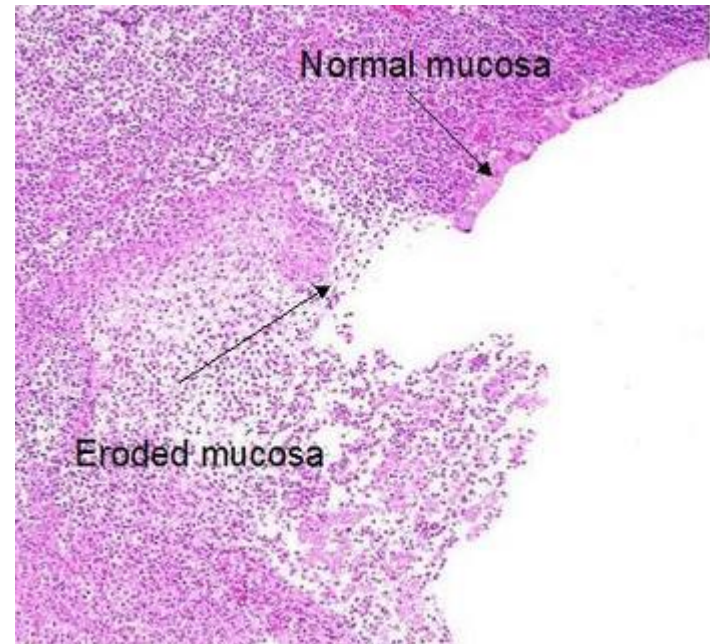
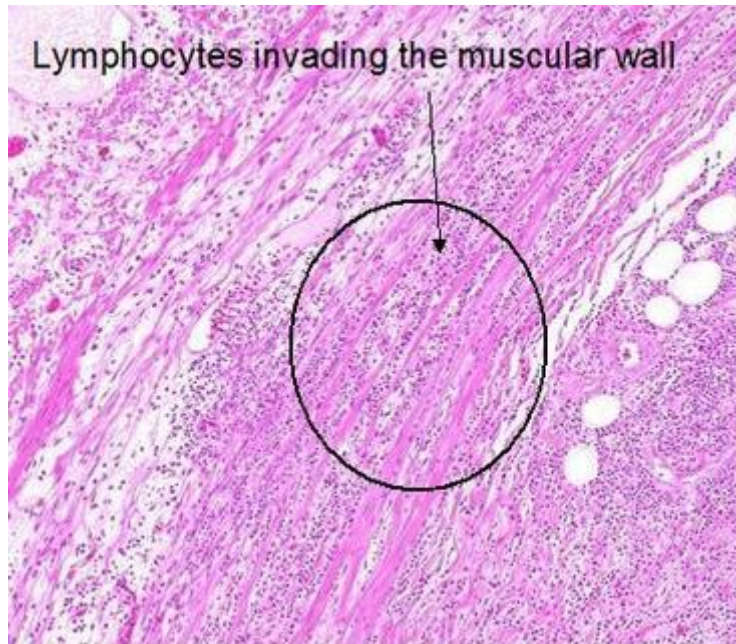
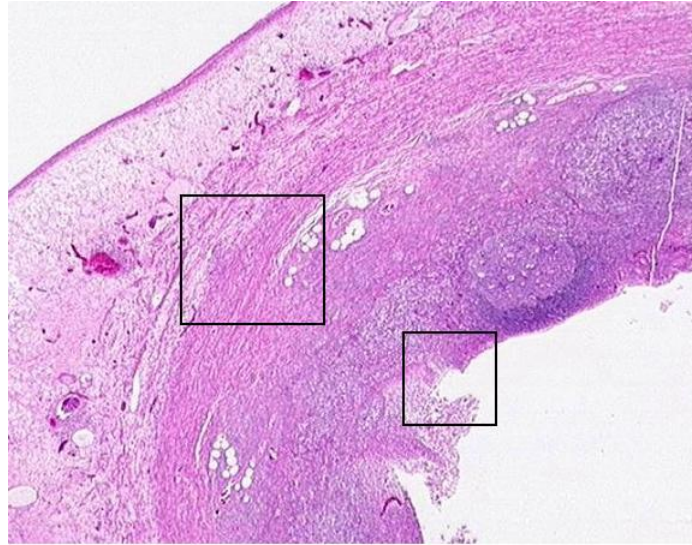
- situated in the midclavicular plane
- attached to the cecum below the iliac valve
- teniae coli converge at the roof of the appendix
- shows various shapes and positions
- its role is analogue with that of tonsils
- McBurney's point;
- deep tenderness (McBurney's sign) → acute appendicitis
- mesoappendix

# Vermiform appendix-"intestinal tonsil"

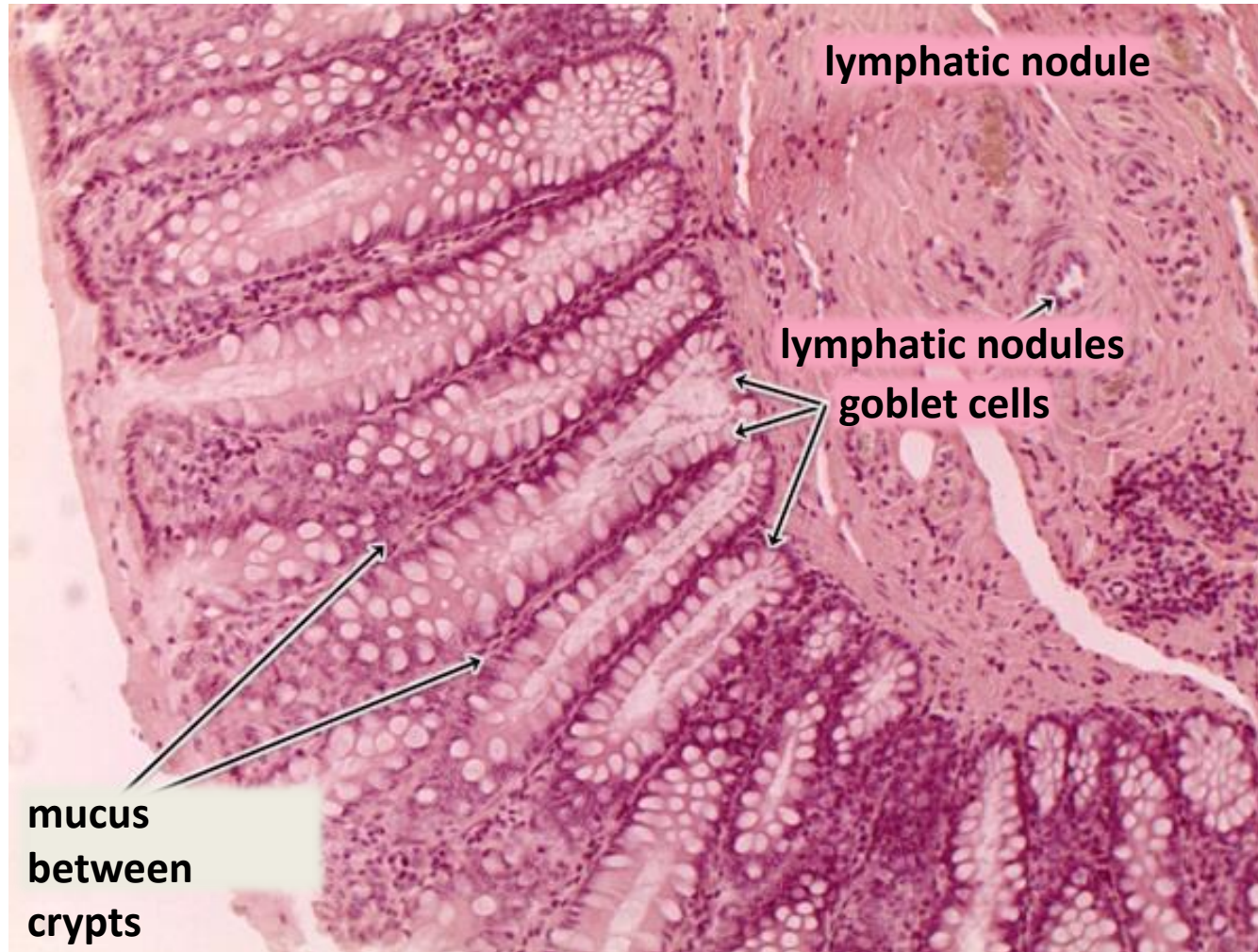


- no taeniae, no villi
- Lieberkühn crypts are less abundant
- lymphatic nodules in the lamina propria - immune function
  - extend into the submucosa

# Appendicitis

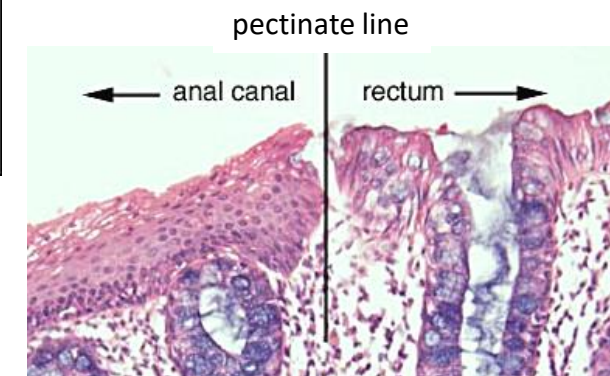
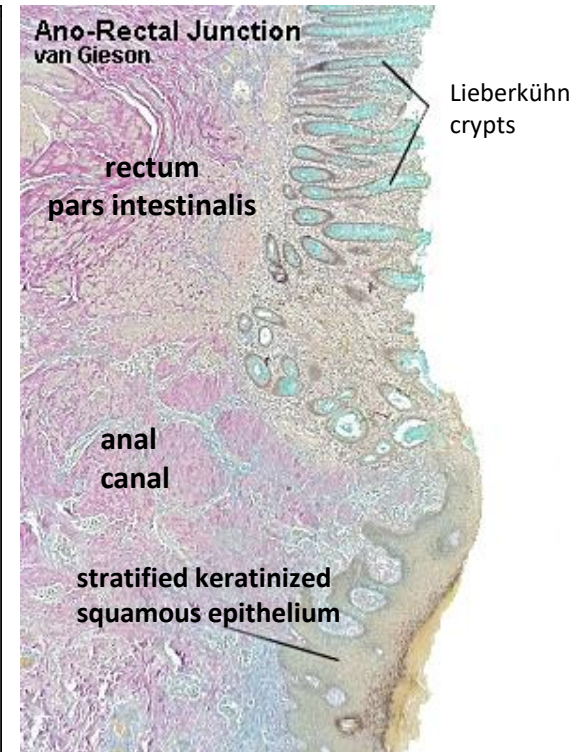
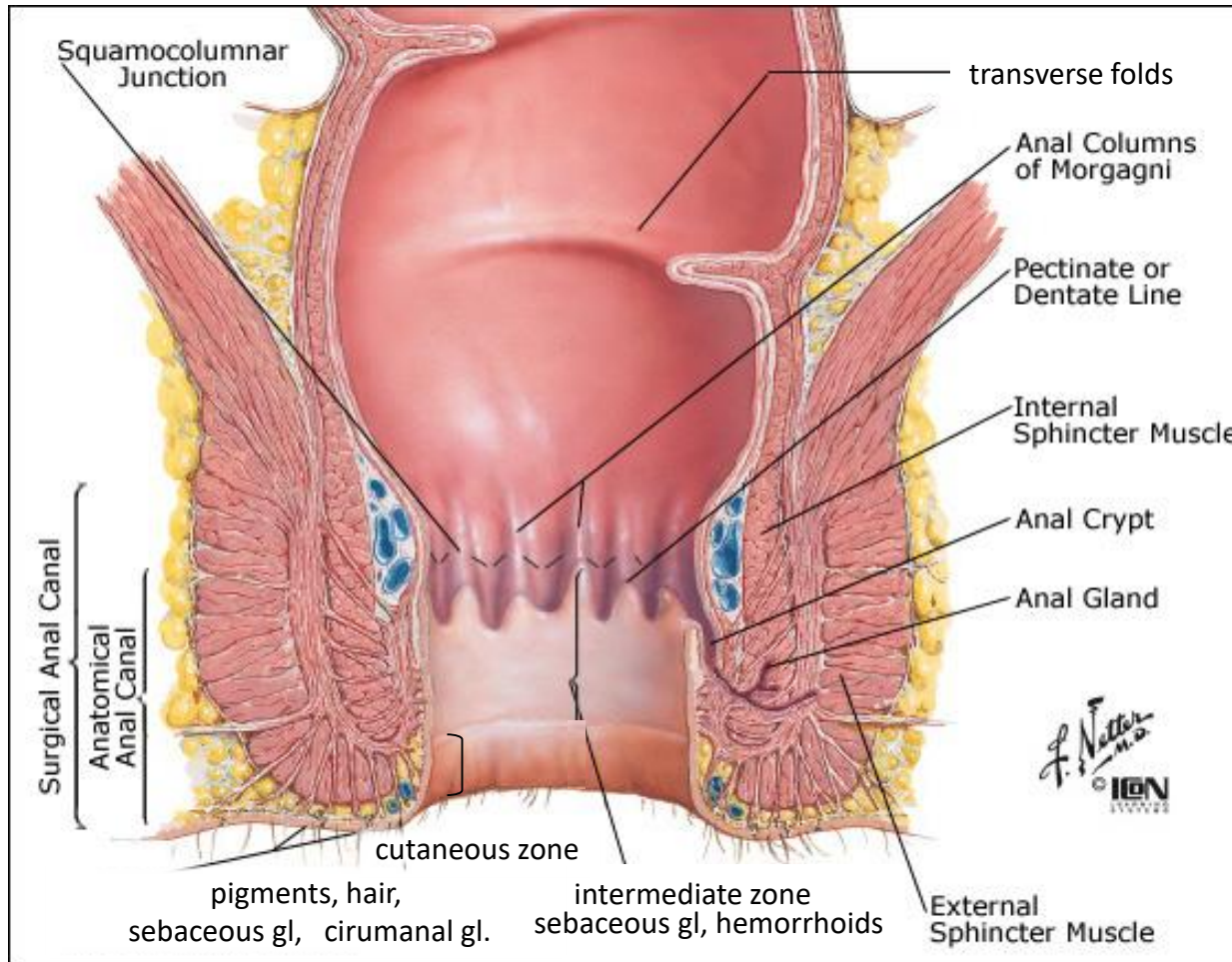


# Rectum – intestinal part



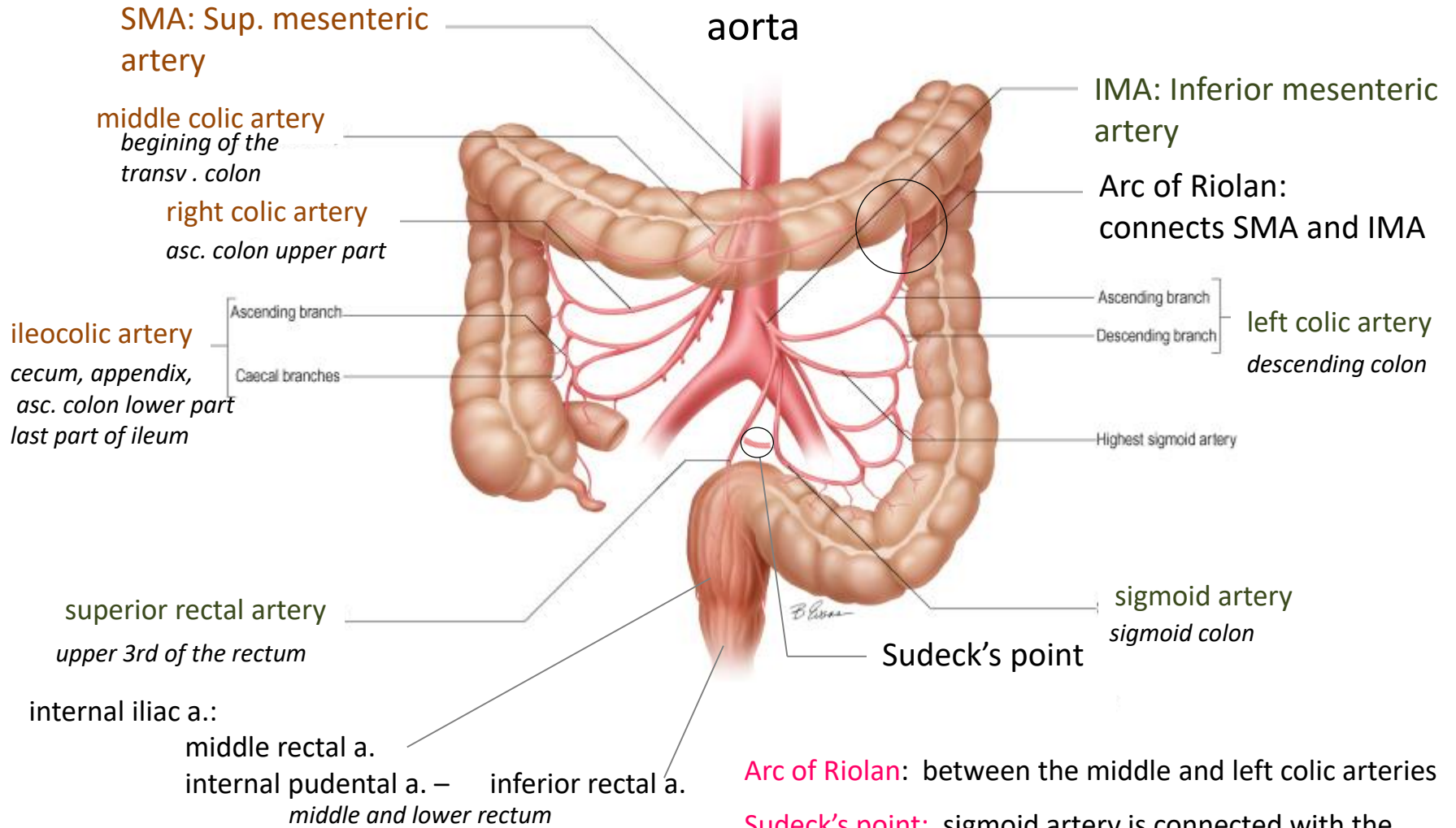
- The longitudinal muscle layer is continuous, there are no teniae.
- Epiploic appendages are missing.
- More goblet cells, deeper crypts, than in the colon.
- Solitary lymphatic nodules.
- No semilunar folds, but transverse folds are present.

# Rectum – anal canal



- columnar zone:
  - columns of Morgagni- stratified squamous *non-keratinized* epithelium
  - sinus anales – simple columnar epithelium
- intermediate zone (haemorrhagica): stratified squamous *non-keratinized* epithelium
- cutaneous zone: stratified squamous *keratinized* epithelium, pigmented

# Arterial supply of the large intestine and the rectum



**Arc of Riolan:** between the middle and left colic arteries

**Sudeck's point:** sigmoid artery is connected with the superior rectal artery



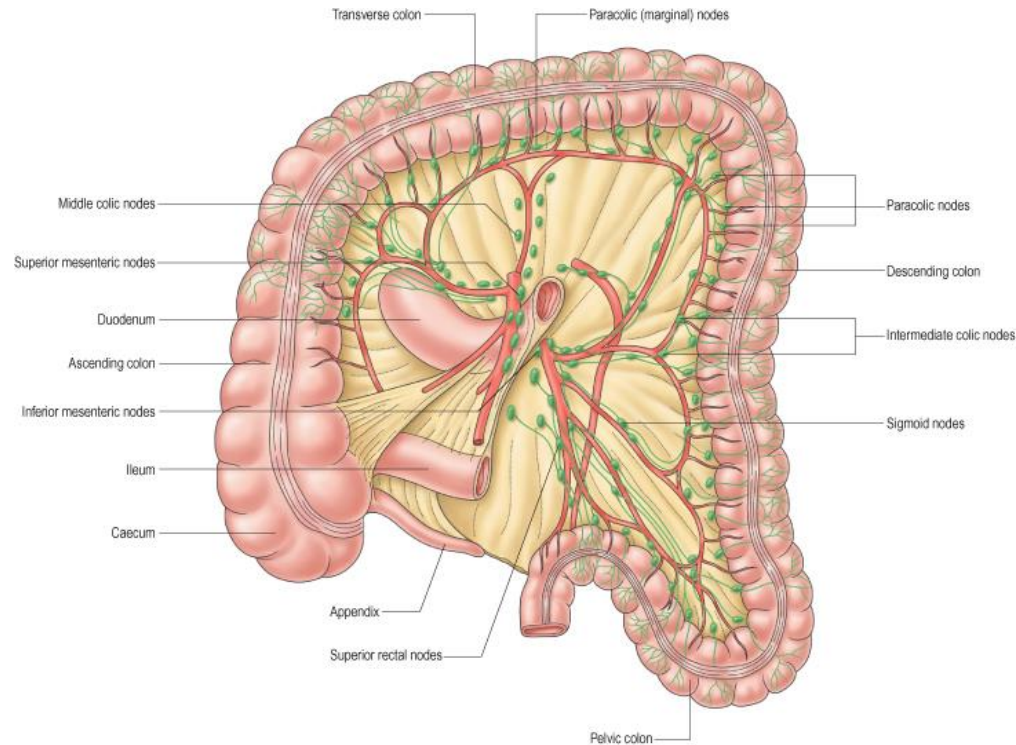




# Lymphatic vessels in the large intestine and the rectum

Lymph nodes are along the arteries, lymph finally gathers in the paraaortic lymph nodes

- cecum, appendix, ascending colon → mesenteric lymph nodes
- transverse colon → mesenteric lymph nodes, lymph nodes between the head of the pancreas and the duodenum, lymph nodes at the hilus of the spleen
- descending and sigmoid colon, rectum → lymph nodes around the aorta
- anal canal → inguinal lymph nodes



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## Regions of Abdominal Area

Right  
hypochoondriac  
region

Epi-  
gastric  
region

Left  
hypochoondriac  
region

Right  
lumbar  
region

Umbilical  
region

Left  
lumbar  
region

Right  
iliac  
region

Hypo-  
gastric  
region

Left  
iliac  
region

