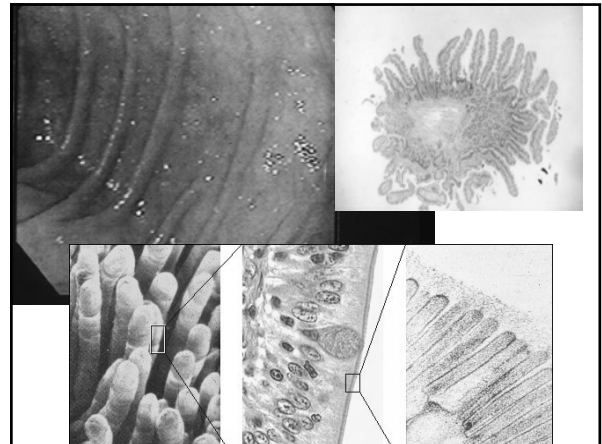


Malabsorption: etiology, pathogenesis and evaluation

Peter HR Green



NORMAL ABSORPTION

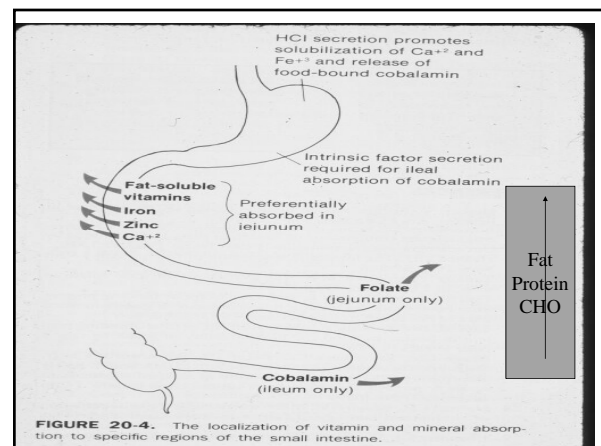
- Coordination of gastric, small intestinal, pancreatic and biliary function
- Multiple mechanisms
 - Fat
 - protein
 - carbohydrate
 - vitamins and minerals

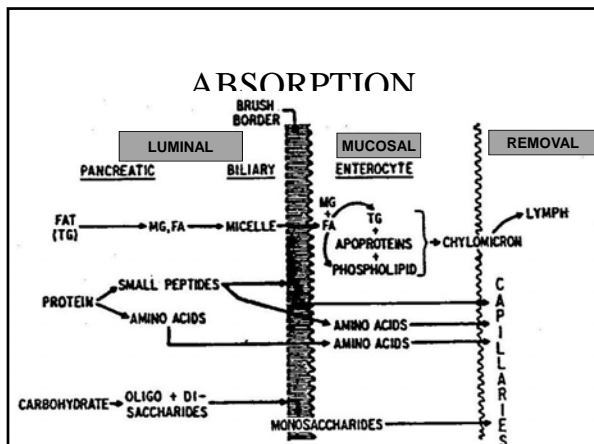
DIFFERENTIAL SITES OF ABSORPTION

- Fat, carbohydrate and protein can be absorbed along the entire length (22 feet)
- Vitamins and minerals are absorbed at different sites

NORMAL ABSORPTION

- Integrated and coordinated response involving different organs, enzymes, hormones, transport and secretory mechanisms
- Great redundancy



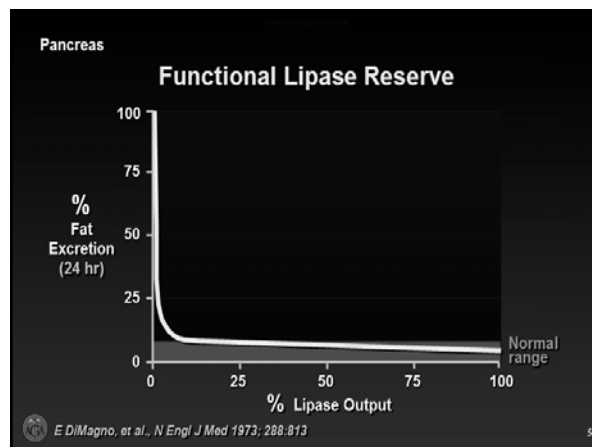


FAT MALABSORPTION

- Luminal phase
 - altered motility - chyme
 - pancreatic insufficiency - pancreatic secretion - lipase, colipase
 - micelle formation - bile salts, lecithin
- Intestinal phase
 - transport, chylomicron formation, secretion
- Transport (lymphatic) phase

FAT ABSORPTION

- GASTRIC PHASE
 - lingual lipase
- INTESTINAL
 - luminal
 - mucosal
 - lymphatic (delivery)



FAT ABSORPTION

- Luminal phase
 - chyme
 - pancreatic secretion - lipase, colipase
 - micelle formation - bile salts, lecithin
- Intestinal phase
 - transport, chylomicron formation, secretion
- Transport (lymphatic) phase

FAT MALABSORPTION

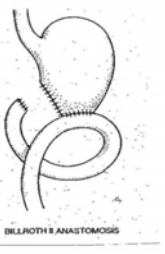
- Luminal phase
 - altered motility - chyme
 - pancreatic insufficiency - cancer, ductal obstruction, chronic pancreatitis
 - biliary tract / liver disease - cirrhosis, bile duct cancer
- SMALL INTESTINAL BACTERIAL OVERGROWTH

SMALL INTESTINAL BACTERIAL OVERGROWTH

BLIND LOOP SYNDROME
JEJUNAL DIVERTICULOSIS
IMPAIRED MOTILITY
(sclerthoderma, celiac disease)

Deconjugation bile salts

Rx antibiotics



FAT MALABSORPTION

- CONSEQUENCES
 - steatorrhea, diarrhea
 - weight loss
 - vitamin deficiency
 - K –bleeding, A –night blindness
 - D –bone disease, E –neurological disorders

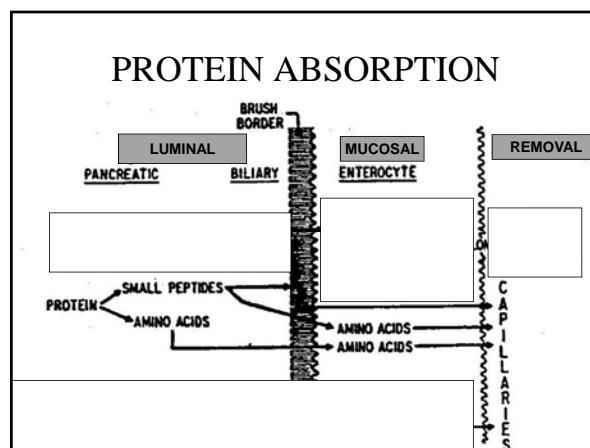
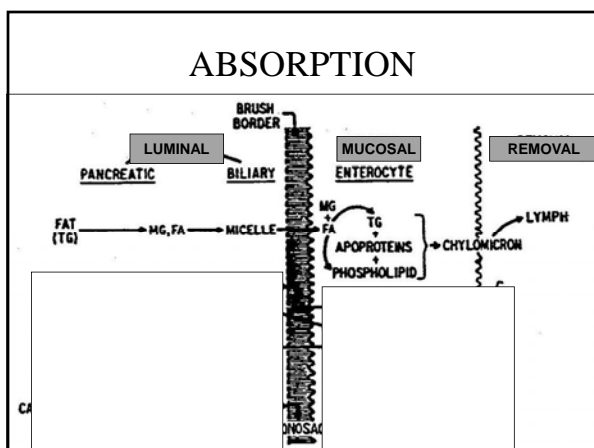
ALL, OR ONLY ONE!!

FAT MALABSORPTION

- **INTESTINAL PHASE**
 - mucosal disease – celiac disease, tropical sprue, Crohn’s disease, radiation, abetalipoproteinemia, chylomicron retention disease, giardiasis
- **REMOVAL PHASE**
 - Lymphatic obstruction (lymphoma)

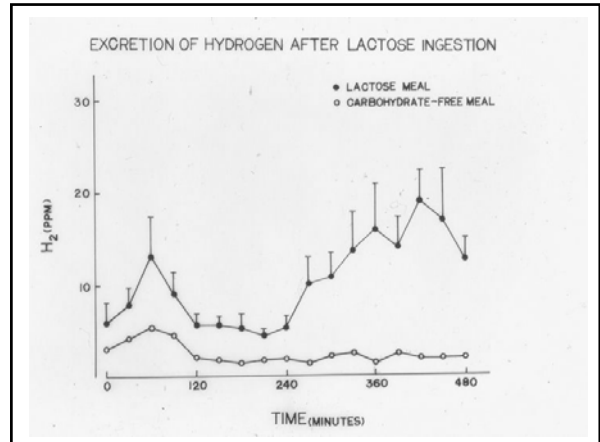
PROTEIN ABSORPTION

- Gastric events – acid, pepsin
- Luminal events – pancreatic secretions trypsin, chymotrypsin secreted as precursors and activated by brush border enzymes, then actively transported.
- Rare congenital disorders of transport

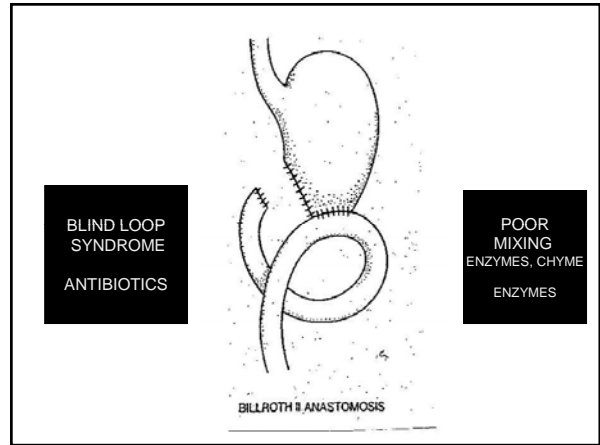
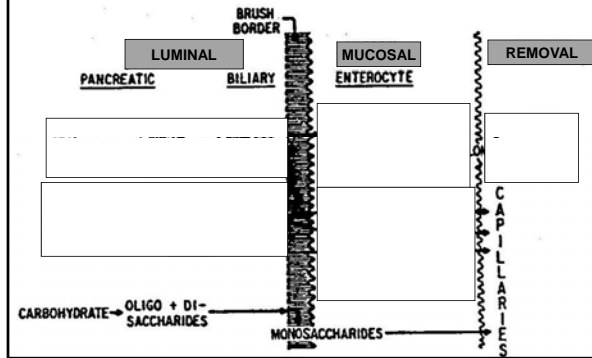


CARBOHYDRATE ABSORPTION

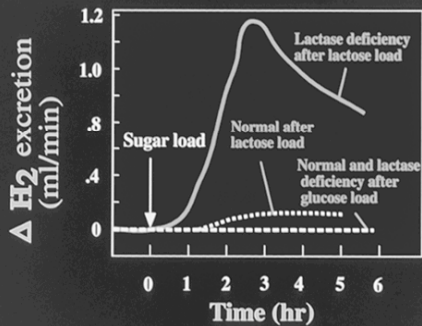
- Salivary amylase
- Pancreatic amylase
 - products of digestion maltose, maltotriose, and a - dextrins, some glucose
 - glucose actively absorbed
 - brush border enzymes digest oligosaccharides (lactase, sucrase)
 - fructose malabsorption



CARBOHYDRATE ABSORPTION



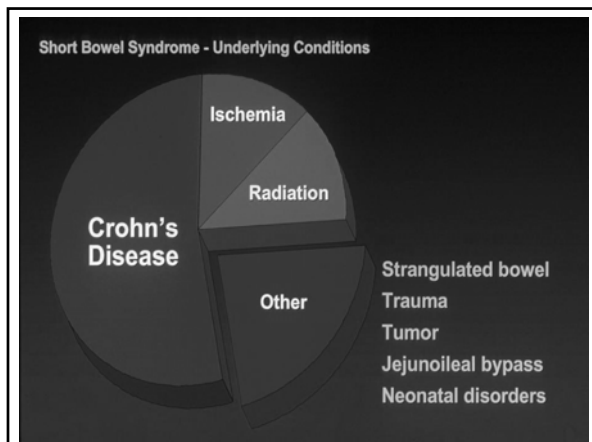
Breath H₂ excretion increases after lactose load in lactase deficiency



ZOLLINGER ELLISON SYNDROME

MULTIPLE MECHANISMS OF DIARRHEA AND MALABSORPTION

- Excessive water and acid production
- Acidification of duodenal contents, deconjugation bile salts, inactivation of enzymes
- Villous atrophy



Short Bowel Syndrome

Extensive Bowel Resection

- Large fluid losses
- Nutrient malabsorption
- Poor jejunal adaptation
- Acid hypersecretion
- Rapid gastric emptying
- Rapid intestinal transit

Short Bowel Syndrome

Jejunal Resection

- Adequate absorption unless >75% resected
- Preserved absorption of B₁₂ and bile salts
- Good ileal adaptation
- Normal transit

23

Consequences of resection

- Site of resection
 - distal bowel present
 - distal bowel absent
- Extent/severity of disease
- Residual disease
- Adaptation of residual intestine
- Age

Short Bowel Syndrome

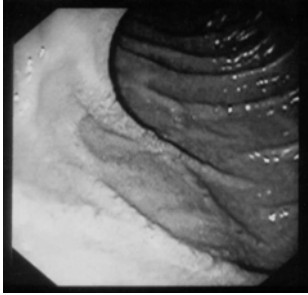
Ileal Resection

- Adequate calorie and fluid absorption
- Malabsorption of
 - bile salts
 - vitamin B₁₂
- Poor jejunal adaptation
- Rapid intestinal transit

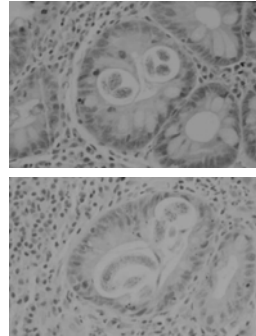
MALABSORPTION DUE TO INFECTIONS

- Giardiasis
- Cryptosporidiasis
- Strongyloides
- Isospora
- Mycobacterium avium

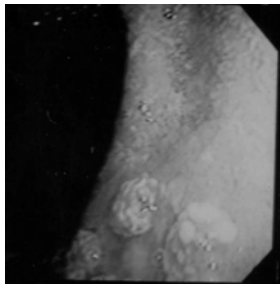
**Upper Endoscopy
Strongyloides**



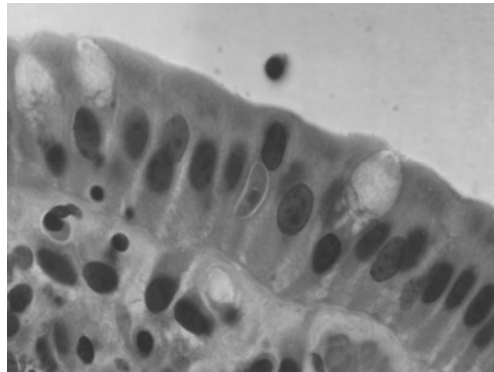
Histology – Strongyloides Stercoralis



Upper Endoscopy



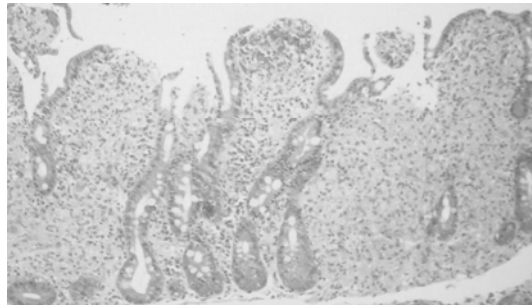
Iso spora belli



Upper GI Series

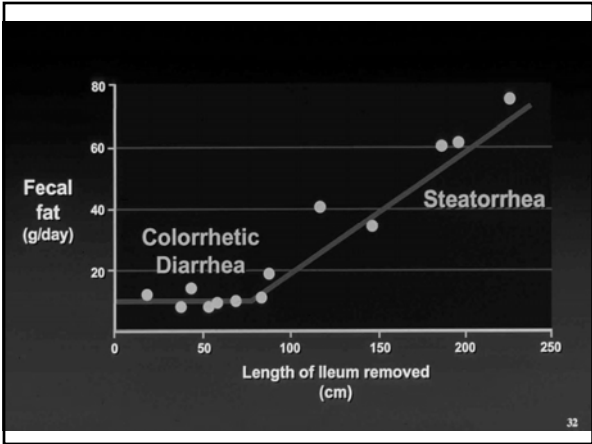
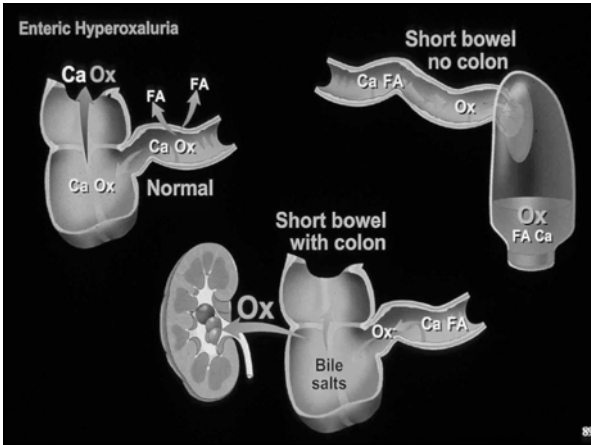
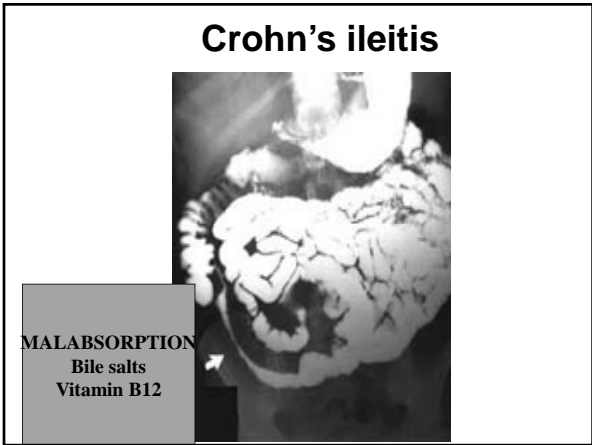


Mycobacterium avium



Malabsorption due to ileal disease/resection

- ### Gallstones and renal stones
- Gall stones are related to bile salt and phospholipid depletion as a result of fat malabsorption and bile salt loss
 - Renal stones are related to excess oxalate absorption as a result of intraluminal soap formation and depletion of calcium ions



- ### EVALUATION OF MALABSORPTION
- CONSEQUENCES
 - weight, BMI
 - ferritin, folate, B12 (methyl malonic acid, homocysteine)
 - zinc, copper
 - calcium, vitamin D, PTH

EVALUATION OF MALABSORPTION

- CAUSE
 - PROXIMAL Vs DISTAL
 - ?steatorrhea (pancreas, biliary, intestinal)
- Radiology (small intestine, CAT, USG)
- Breath tests (bacterial overgrowth, lactose, fructose)
- Biopsy
- Video capsule endoscopy

EVALUATION OF MALABSORPTION

- STOOL
 - O&P
 - GIARDIA ANTIGEN
 - FECAL FAT – quantitative, qualitative
 - PANCREATIC ELASTASE