MALABSORPTION

TUCOM
Internal Medicine
Dr. Mohamed Ghalib

OBJECTIVES

- ✖ Outline the function of small intestine.
- ✖ Define malabsorption.
- ✖ Identify the causes and pathogenesis of malabsorption.
- ✖ Explain the clinical manifestations of malabsorption.
- ✖ Review the investigations of malabsorption.
- ✖ Recognize the definition, causes, clinical features, investigations, management and complications of celiac disease.
- ✖ List the causes of subtotal villous atrophy.
- ✖ Define the following: Dermatitis herpetiformis, tropical sprue, small bowel bacterial overgrowth and ileal resection malabsorption.

The main role of your small intestine is to absorb nutrients from the food you eat into your bloodstream. Malabsorption syndrome refers to a number of disorders in which the small intestine can't absorb enough of certain nutrients and fluids.

The average length of the small intestine in an adult is about 7 m. Which divided into three parts: duodenum, jejunum and ileum.

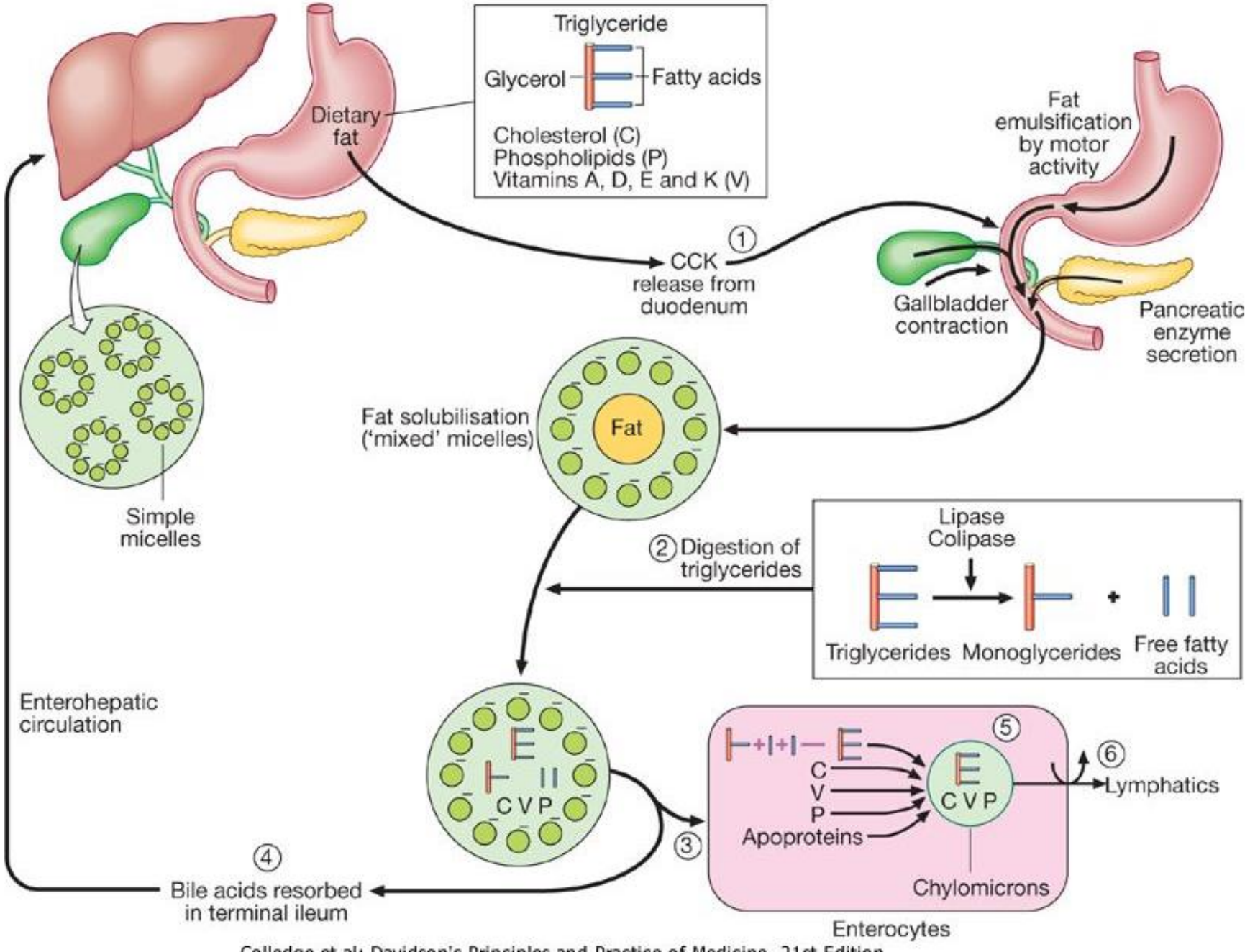
Functions of the small intestine are:

1-Digestion; By peristaltic activity and enzymatic action, to complete digestion of fat, carbohydrates and proteins.

2-Absorption; The products of digestion, water, electrolytes and vitamins.

3-Protection; Against ingested toxins. Immunological, mechanical, enzymatic and peristaltic activity.

1- Digestion and absorption of fat



2- Digestion and absorption of carbohydrates

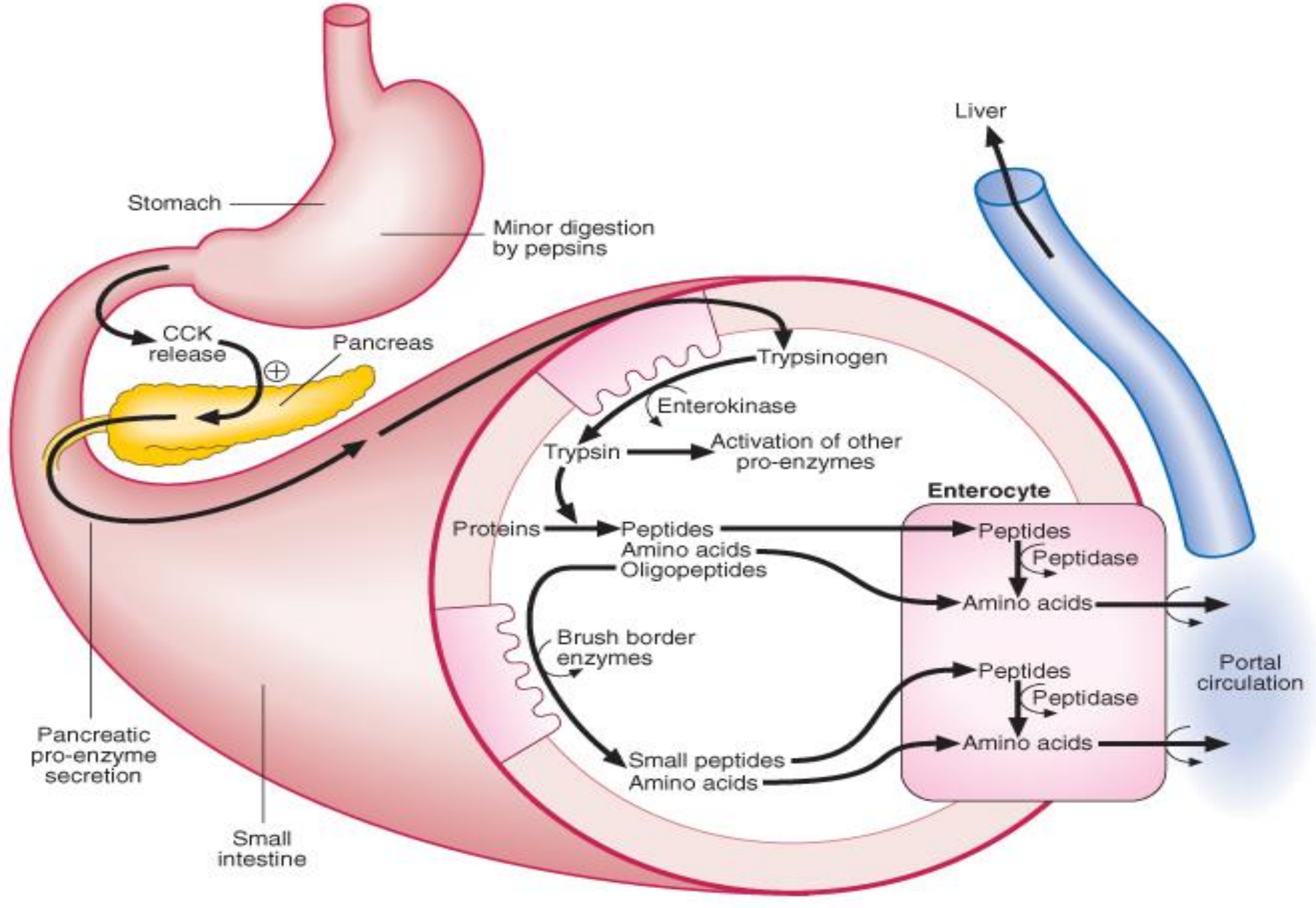
Carbohydrates composed of;

A- Polysaccharide starch; Is hydrolysed by salivary and pancreatic amylases to alpha-limit dextrins: maltose and maltotriose.

B- Disaccharides (sucrose and lactose); are hydrolyzed by brush border sucrase and lactase enzymes to momosaccharides.

C- Monosaccharides; Glucose, galactose are actively transport and fructose by simple diffusion.

3- Digestion and absorption of proteins



MALABSORPTION

Define; as a clinical syndrome due to diminished intestinal absorption of one or more dietary nutrients. Includes a broad spectrum of conditions with multiple aetiologies and varied clinical manifestation.

Aetiology and pathogenesis; due to abnormalities of the three processes of normal digestion.

1-Intraluminal maldigestion

a-Reduced Nutrient Availability

Cofactor deficiency (pernicious anemia, gastric surgery)

Nutrient consumption (bacterial overgrowth)

b-Impaired Fat Solubilization

Reduced bile salt synthesis (hepatocellular disease)

Impaired bile salt secretion (chronic cholestasis)

Bile salt inactivation (bacterial overgrowth)

Increased bile salt losses (terminal ileal disease)

c-Defective Nutrient Hydrolysis

Lipase inactivation (ZE syndrome)

Enzyme deficiency (pancreatic insufficiency or cancer)

Improper mixing or rapid transit (resection, bypass, hyperthyroidism)

2-Mucosal malabsorption

a-Extensive mucosal loss (resection or infarction)

b-Diffuse mucosal disease (celiac disease, Crohn's disease, irradiation, infection, infiltrations)

c-Brush border hydrolase deficiency (lactase deficiency)

d-Epithelial processing (abetalipoproteinemia)

3-Postmucosal malabsorption

a-Vascular conditions (vasculitis, atheroma)

b-Lymphatic conditions (lymphangiectasia, irradiation, nodal tumor, cavitation, or infiltrations)

Multiple Mechanisms;

Example: Subtotal gastrectomy leads to premature gastric emptying resulting in impaired mixing of food with bile and pancreatic enzymes, associated with bacterial overgrowth due to hypochlorhydria.

Clinical manifestations of malabsorption

- Early features; usually diarrhea and weight loss.
- Late features; symptoms and signs of nutrient deficiencies.

1-Gastrointestinal Signs;

a-Steatorrheic stool; Mucosal disease (celiac disease), bacterial overgrowth, or pancreatic insufficiency. Or watery diarrhea as in bile salt malabsorption.

b-Distention; Intestinal obstruction, gas, ascites, pseudocyst (pancreatic).

c-Mass; Crohn's disease, lymphoma, tuberculosis.

2- Extraintestinal Signs

1-Skin;

a-Nonspecific; Pigmentation, thinning, inelasticity, reduced subcutaneous fat.

b-Specific; Blisters (dermatitis herpetiformis), erythema nodosum (Crohn's disease), petechiae and purpura (vitamin K and C deficiency), edema (hypoproteinemia), acrodermatitis enteropathica (zinc deficiency), follicular hyperkeratosis (vitamin A deficiency).

2-Hair; Alopecia or thinning; Gluten sensitivity (celiac disease), hypothyroidism

3-Eyes;

a-Conjunctivitis, episcleritis; Crohn's disease, Behçet's syndrome

b-Paleness; Severe anemia.

c- Night blindness and Bitot’s spot; vit. A deficiency.

4-Mouth;

a- Aphthous ulcers; Crohn's disease, celiac disease, Behçet's syndrome

b-Glossitis; Defici. of vit. B_{12}, iron, folate and niacin

c-Angular cheilosis; Deficie of vit. B_{12}, iron, folate, B complex

d-Dental hypoplasia (pitting/dystrophy); celiac disease

e- Gum bleeding; vit. C deficiency.

4-Hands;

a-Raynaud's phenomenon; Scleroderma

b-Finger clubbing; Crohn's disease, lymphoma

c-Koilonychia; Iron deficiency

d-Leukonychia; hypoproteinemia

5-Musculoskeletal;

a-Mono/polyarthropathy; Crohn's disease, celiac disease, Whipple's disease, Behçet's syndrome

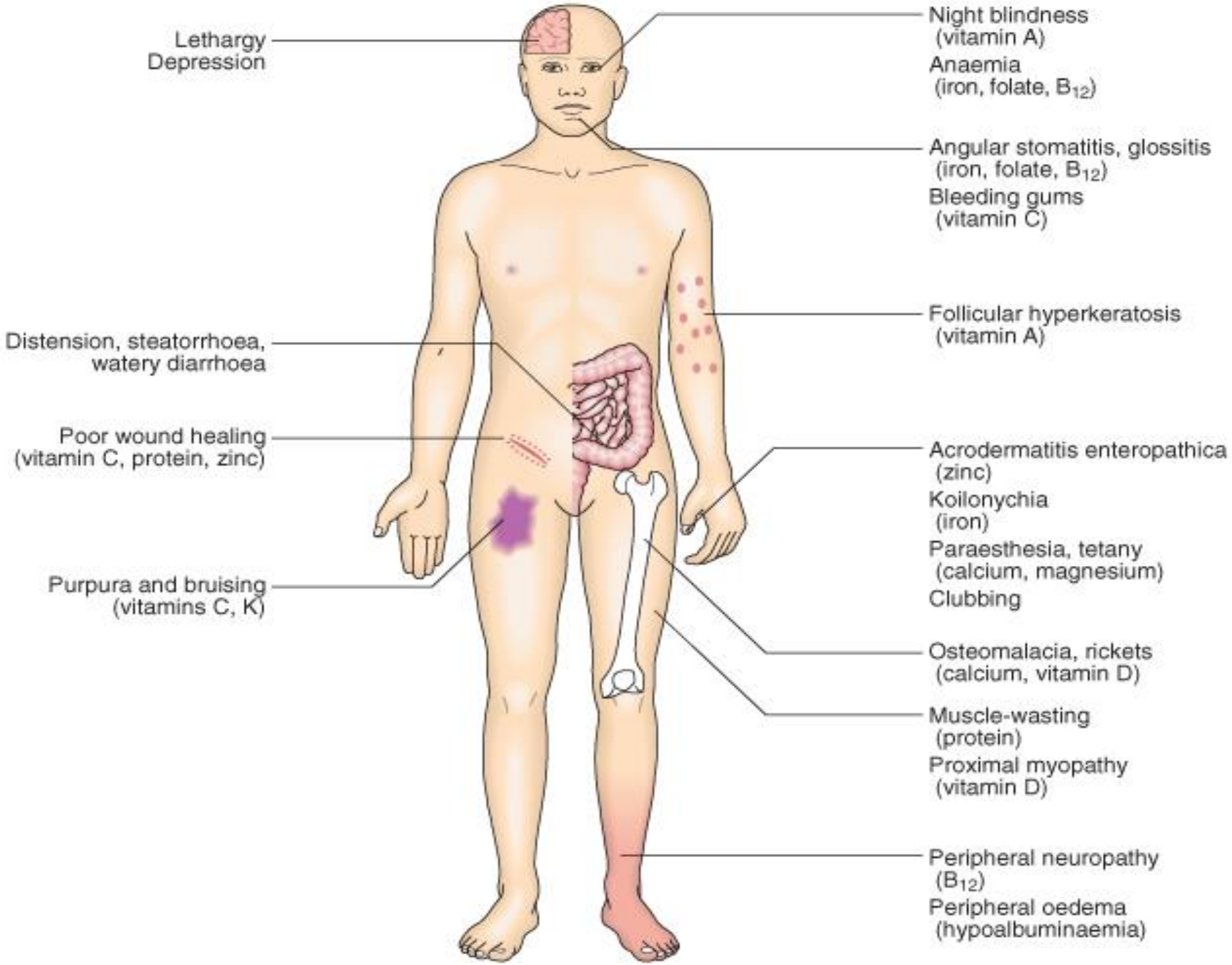
b-Back pain (osteomalacia/ osteoporosis/ sacroiliitis); Crohn's disease, celiac disease, vit. D deficiency.

c-Muscle weakness; (low K, magnesium, vitamin D).

6-Nervous system;

a-Peripheral neuropathy; (weakness, paresthesias, numbness); Vitamin B_{12} deficiency

b-Cerebral; (seizures, dementia, intracerebral calcification, meningitis, cranial nerve palsies); Whipple's disease, gluten sensitivity, diffuse lymphoma.


Lethargy
Depression
Night blindness
(vitamin A)
Anaemia
(iron, folate, B_{12})
Angular stomatitis, glossitis
(iron, folate, B_{12})
Bleeding gums
(vitamin C)
Follicular hyperkeratosis
(vitamin A)
Distension, steatorrhoea,
watery diarrhoea
Poor wound healing
(vitamin C, protein, zinc)
Acrodermatitis enteropathica
(zinc)
Koilonychia
(iron)
Paraesthesia, tetany
(calcium, magnesium)
Clubbing
Purpura and bruising
(vitamins C, K)
Osteomalacia, rickets
(calcium, vitamin D)
Muscle-wasting
(protein)
Proximal myopathy
(vitamin D)
Peripheral neuropathy
(B_{12})
Peripheral oedema
(hypoalbuminaemia)

Bulky, oily, pale and offensive stools which float in the toilet (steatorrhoea) signify fat malabsorption.


A.D.A.M.


VIBHUTI SINGH, MD, MPH


DOIA
(c) University Erlangen,
Department of Dermatology

Fig. 2-5 Periodontal disease seen in scurvy.


http://dermis.net

Diagnosis and investigations

1-Routine blood test;

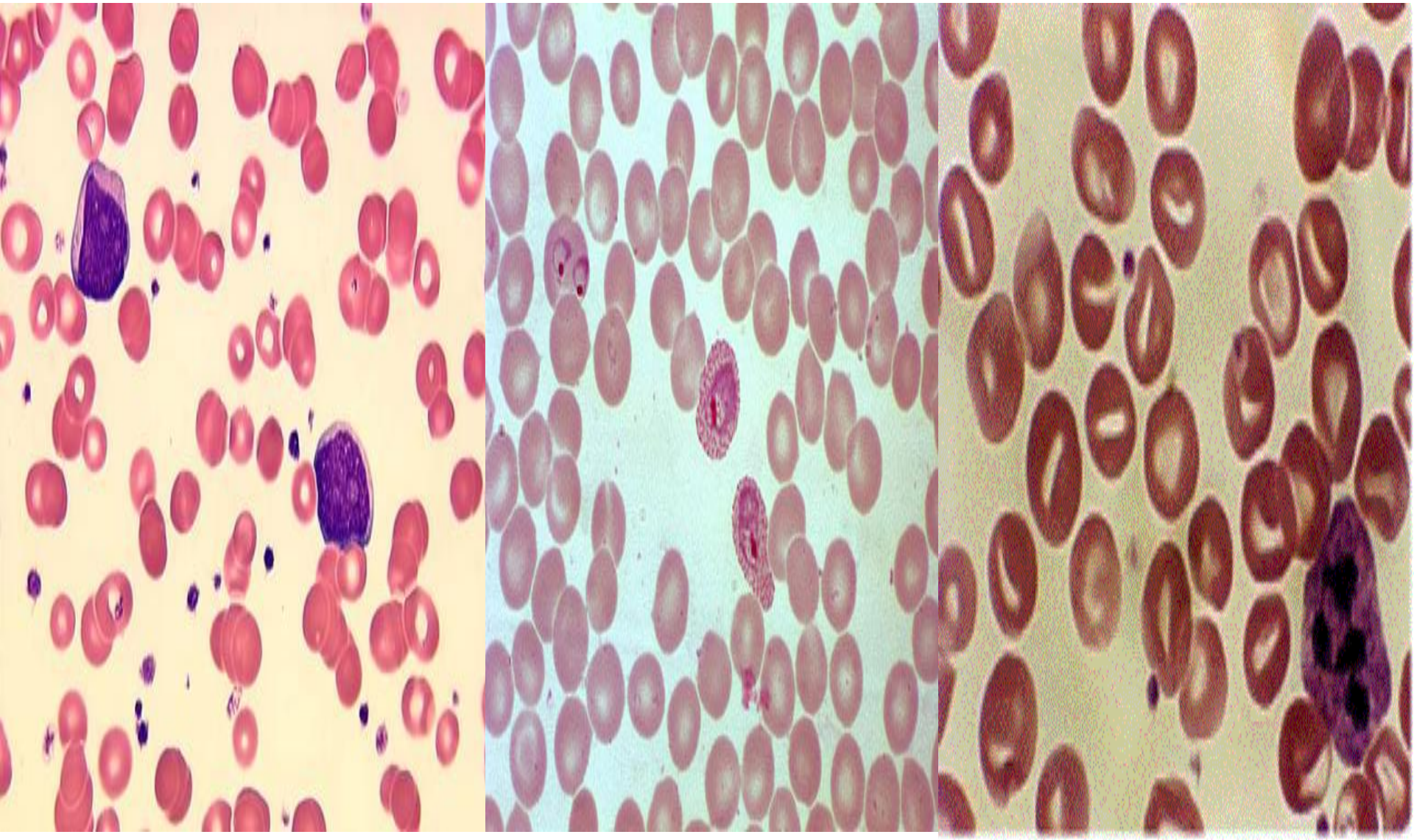
a-Haematology;

- Microcytic anaemia (iron deficiency)
- Macrocytic anaemia (folate or B_{12} deficiency)
- Increased prothrombin time (vitamin K deficiency)

b-Biochemistry;

- Hypoalbuminaemia
- Hypocalcaemia
- Hypomagnesaemia
- Deficiencies of phosphate and zinc

c-Serology; IgA antiendomysial Ab +ve in celiac dis.



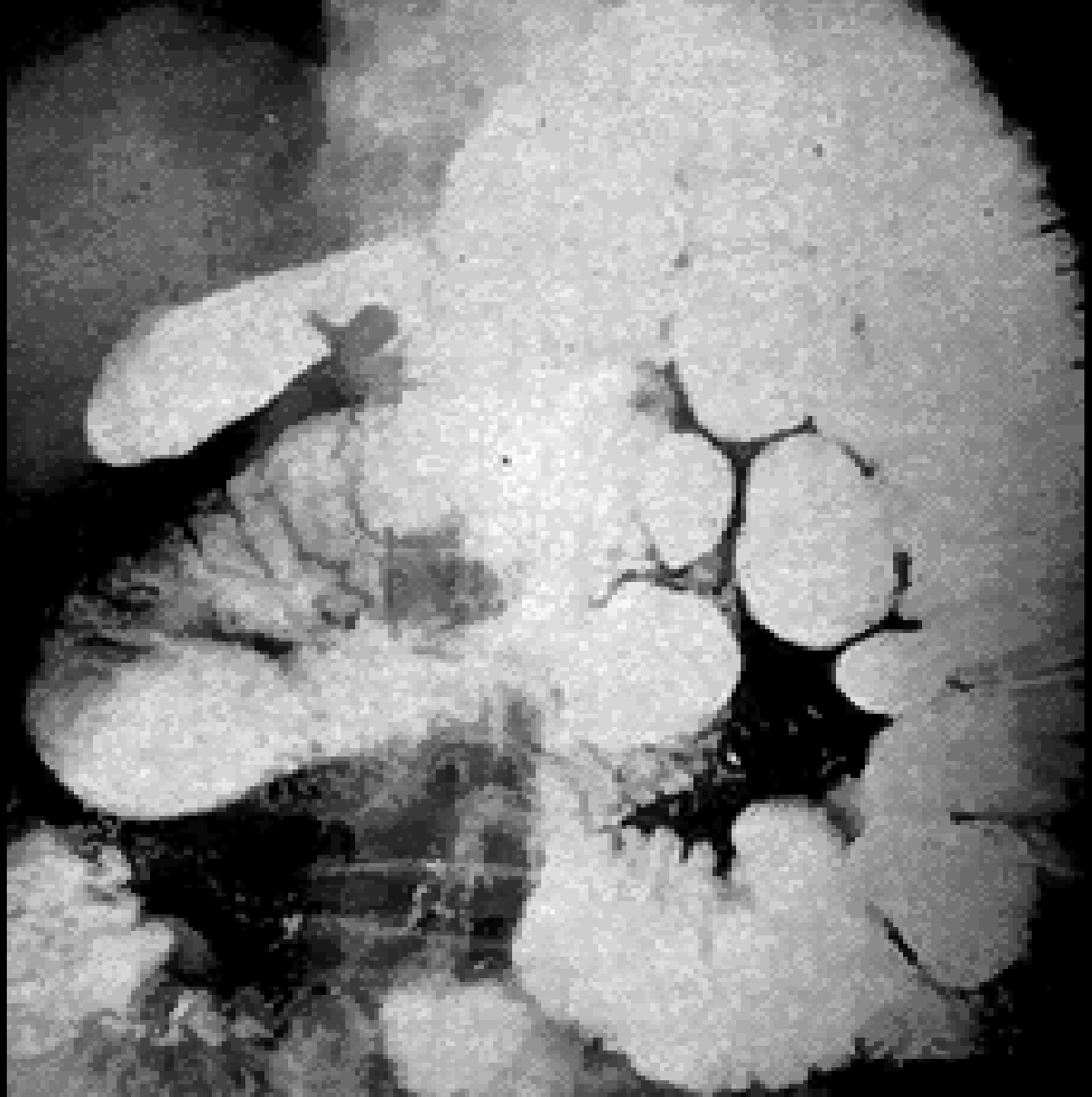
2-Investigations of small intestinal malabsorption;

a-Endoscopic doudenal biopsies; Replaced jejunal sampling indicated when mucosal diseases suspected.

b-Barium studies;

Nonspecific; Thin-walled, dilated loops of bowel as in celiac disease

Specific; Jejunal diverticulosis, lymphoma, Crohn's disease, strictures, or enteric fistulas

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C-Sugar permeability test(D-xylose test);

D-xylose is a monosaccharide transported by passive diffusion, ingests 25 g, urine is collected for the next 5 hours, more than 4.5 g of D-xylose in 5 hours (or ≥20% of the ingested load).

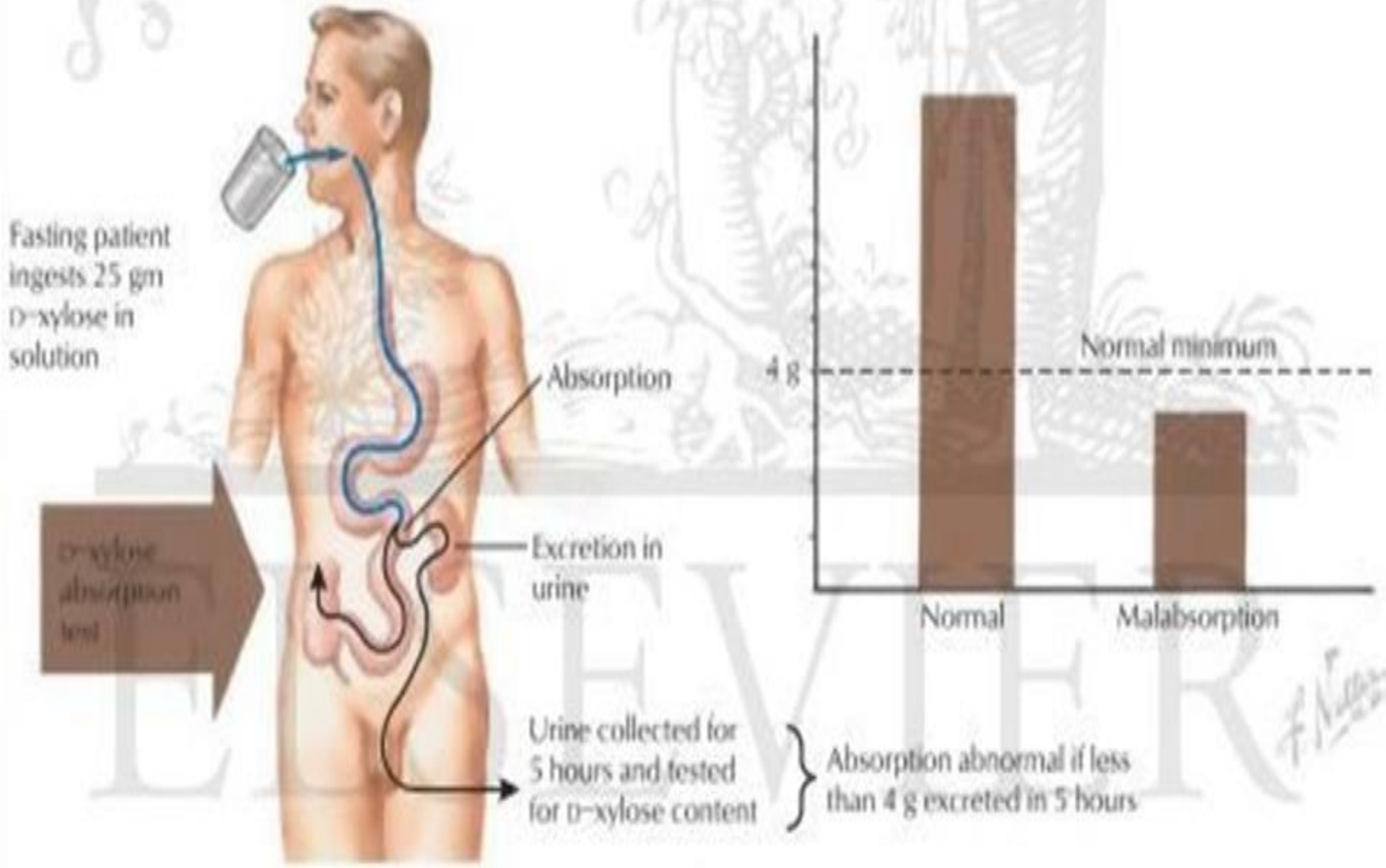
3-Investigations of pancreatic exocrine function;

a- aspiration of duodenal contents after stimulation of the pancreas.

b-blood (trypsinogen) level

c-stool (chymotrypsin or elastase) level

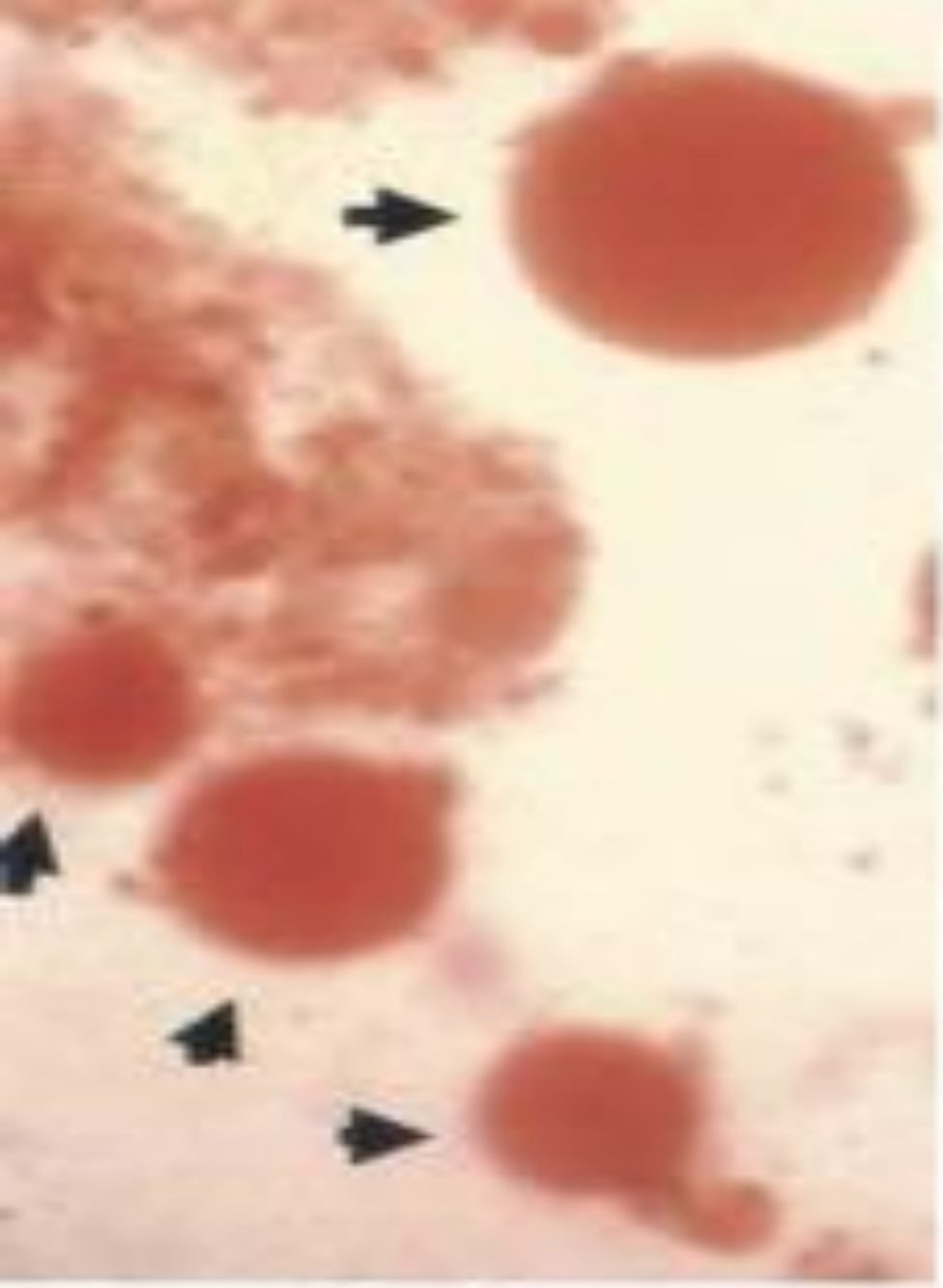
d-Pancreatic calcifications seen on abdominal films or CT scan indicate the presence of chronic pancreatitis.



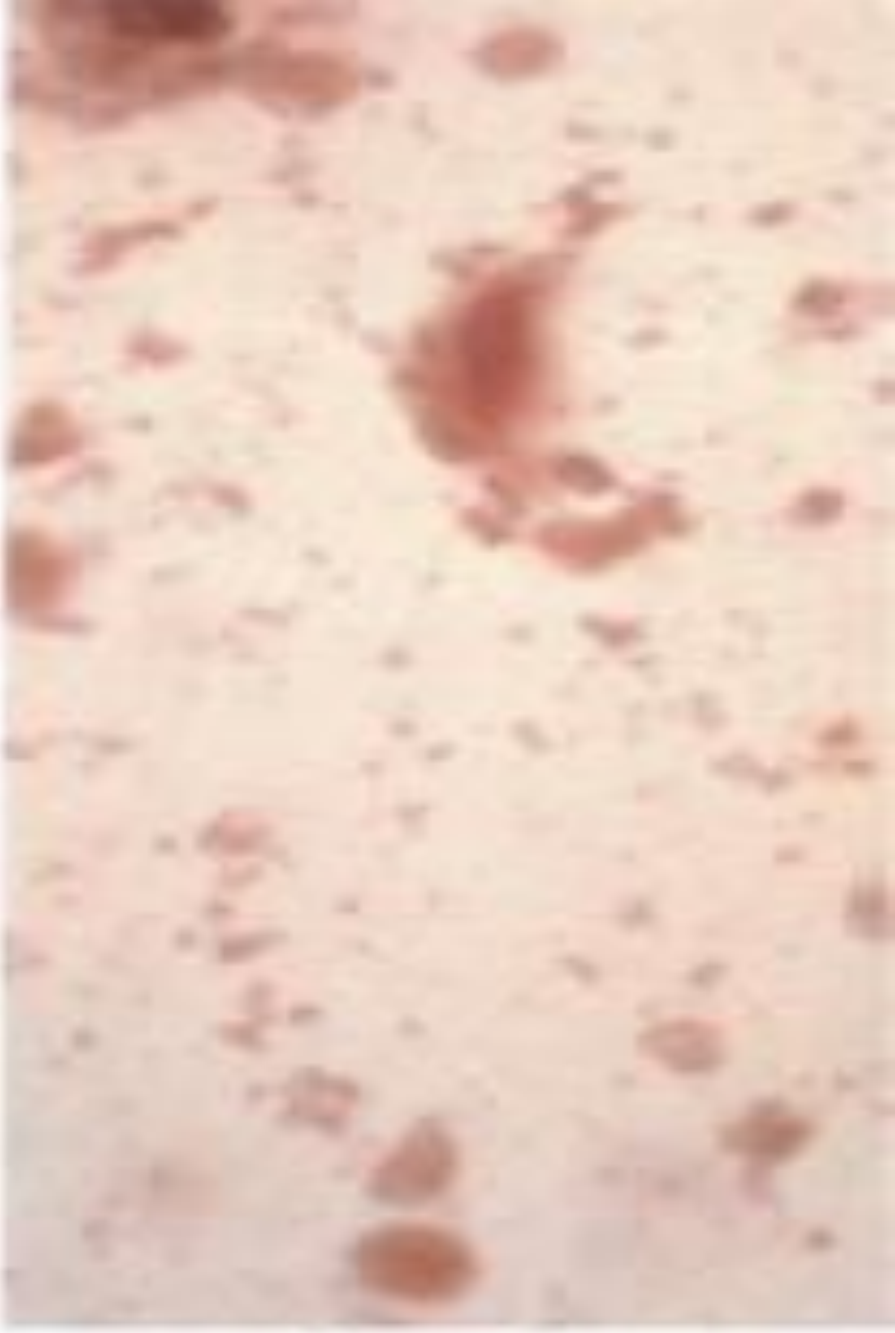
4-Investigations of fat malabsorption (fecal fat analysis);

a- The simplest qualitative method for detecting stool fat is the microscopic examination of a Sudan stain of a drop of stool.

b- A more accurate test is the quantitative measurement of fecal fat, ingestion of 100 g of fat per day, stool collected for 3 days. Normal fat excretion should not exceed 6 g/day.



Positive



Negative

5-Investigations of bile salt malabsorption (SeHCAT test);

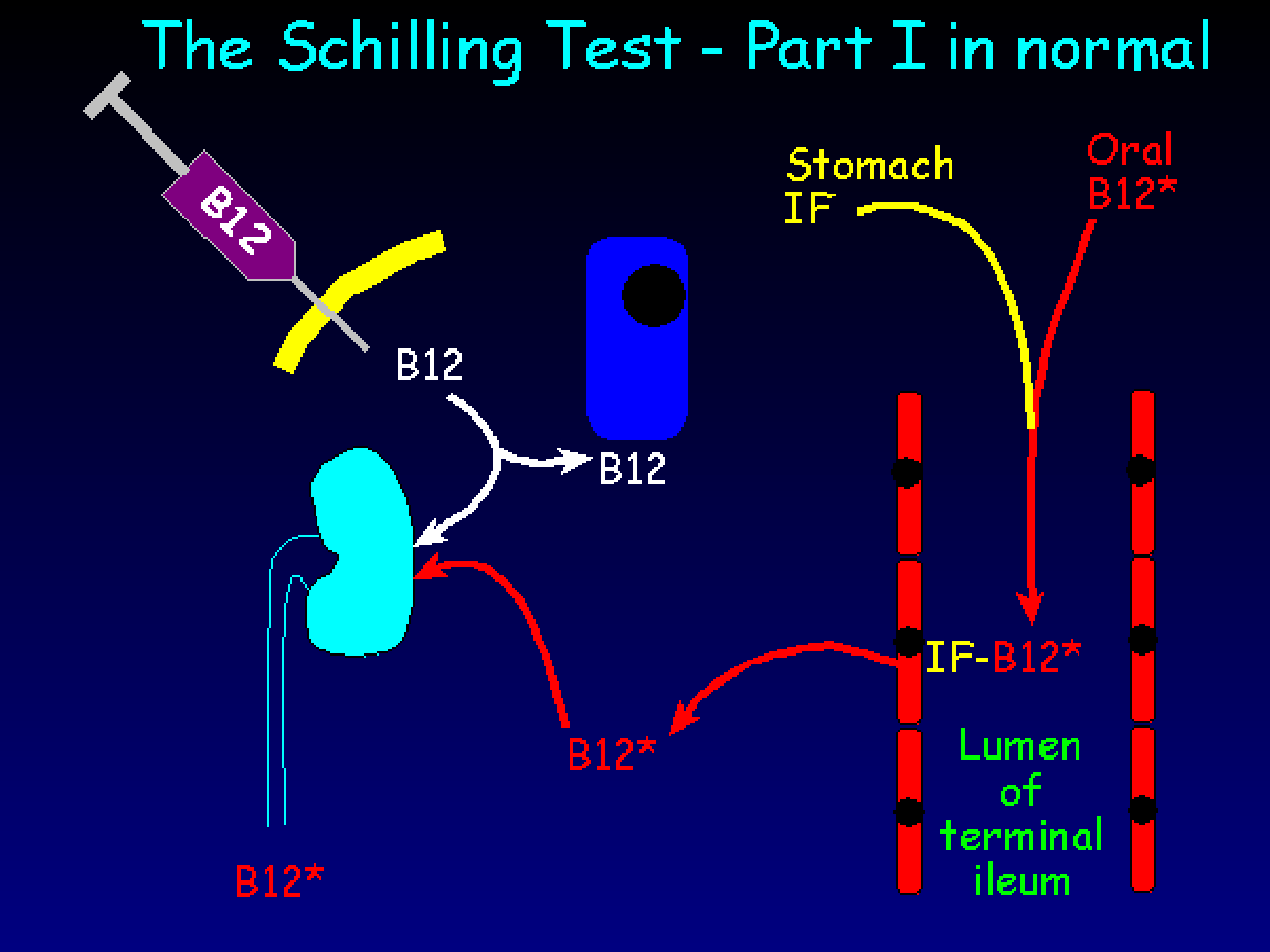
SeHCAT is radiolabeled bile salt in capsule. It's serum level of less than 15% after ingestion of capsule is abnormal.

6-Schilling test (vitamin B_{12} malabsorption);

using a radiolabeled vitamin B_{12} as a marker.

malabsorption of vitamin B_{12} can occur because of lack of intrinsic factor (e.g., pernicious anemia or gastric resection), pancreatic insufficiency, bacterial overgrowth, or ileal disease.

The Schilling Test - Part I in normal



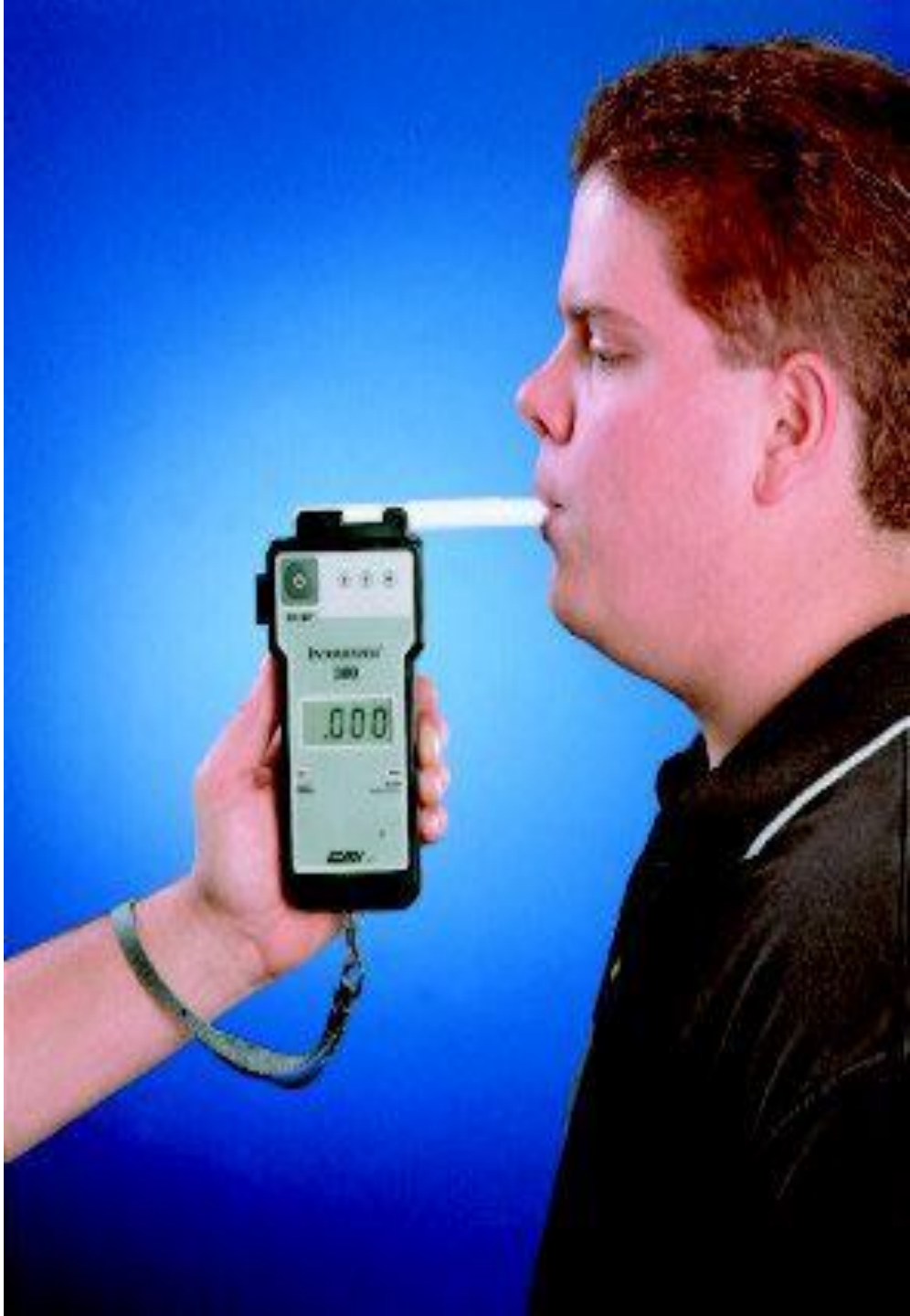
7- BREATH TESTS;

a- Hydrogen breath test; (lactose intolerance);

where bacterial fermentation liberates hydrogen gas.

b- ^{14}C breath test;

measurement of radioactive CO_2 increase in bacterial overgrowth .

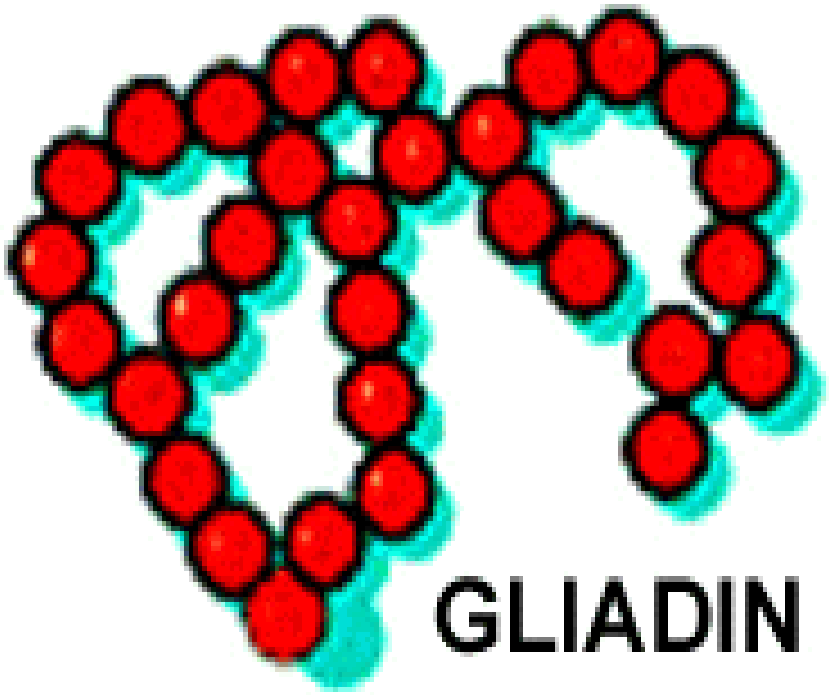


COELIAC DISEASE

Coeliac disease; is an immunologically mediated inflammatory disorder of the small bowel occurring in genetically susceptible individuals and resulting from intolerance to wheat gluten and similar proteins found in rye, barley and, to a lesser extent, oats.

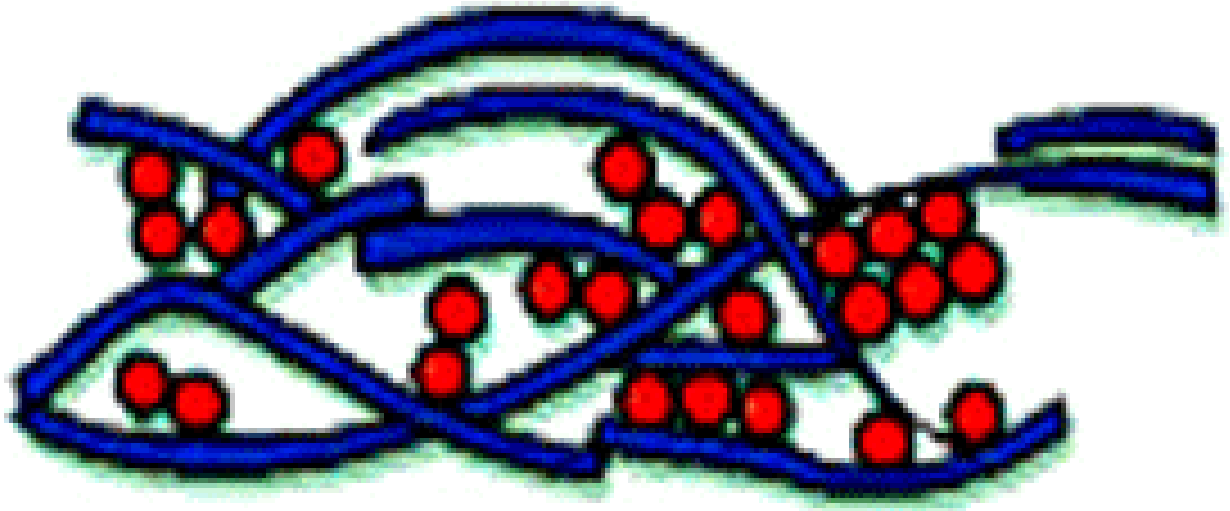
Gluten = Glutenin + Gliadin.

Tissue transglutaminase (TTG) is the autoantigen for anti-endomysial antibodies, used in serological diagnosis.



GLIADIN

GLUTENIN



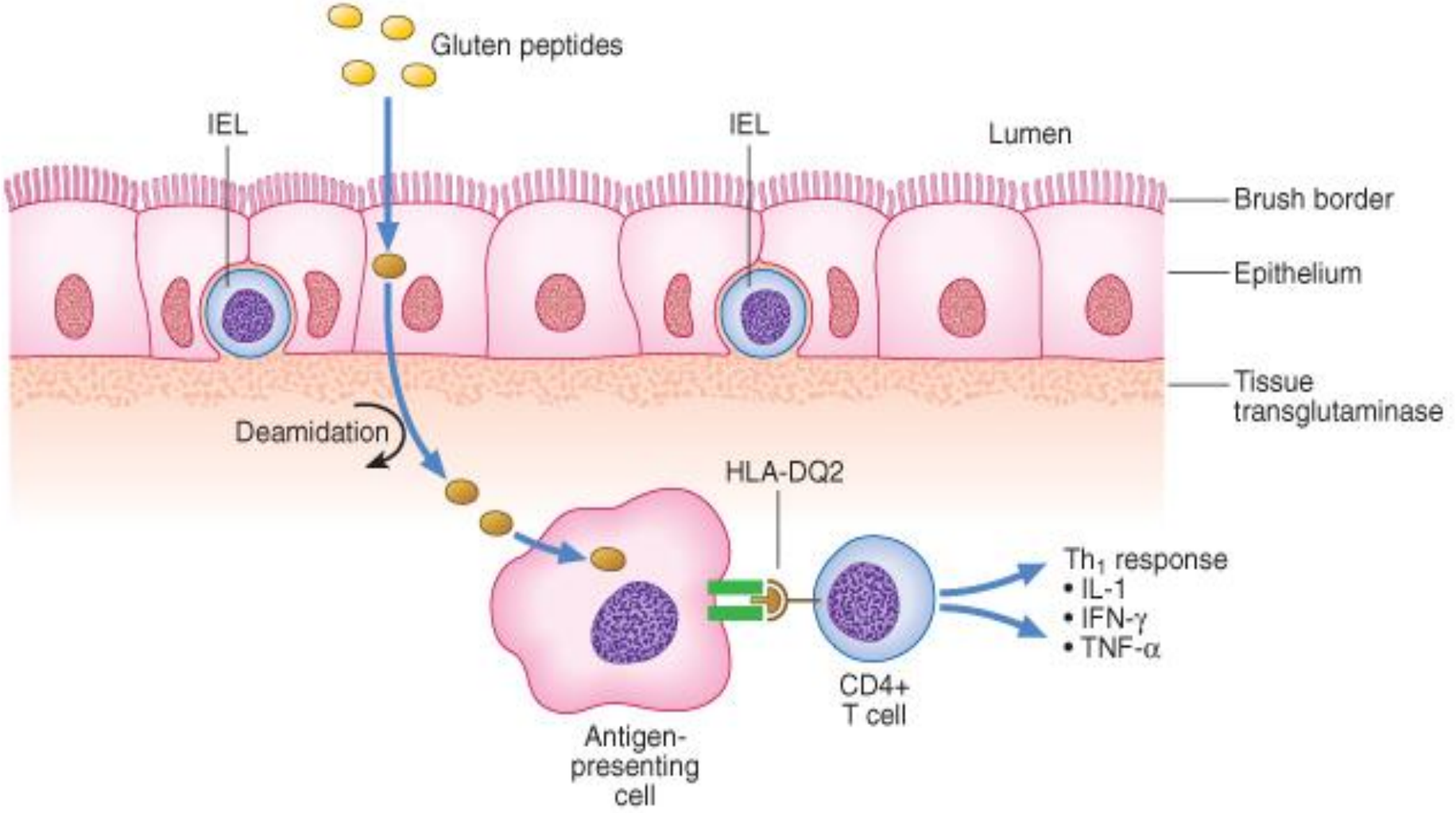
GLUTEN (GLIADIN + GLUTENIN)


Wheat


Barley


Rye

Oats



After being taken up by epithelial cells, gluten peptides are deamidated by the enzyme tissue transglutaminase in the subepithelial layer. They are then able to fit the antigen-binding motif on HLA-DQ2 positive antigen presenting cells. Recognition by CD4+ T cells triggers a Th_1 immune response with generation of pro-inflammatory cytokines (IL-1, IFN-γ and TNF-α). Lymphocytes infiltrate the lamina propria, and increased intraepithelial lymphocytes (IEL), crypt hyperplasia and villous atrophy ensue.

Clinical features;

- **Typical features; presents with steatorrhea, with abdominal distension, weight loss, and delayed growth.**
- **Atypical features; tiredness, folate or IDA or oral ulcers.**
- **Extraintestinal features; depression, arthralgias, osteoporosis, or osteomalacia .**
- **Associations; dermatitis herpetiformis, type 1 diabetes mellitus, autoimmune thyroid disease.**

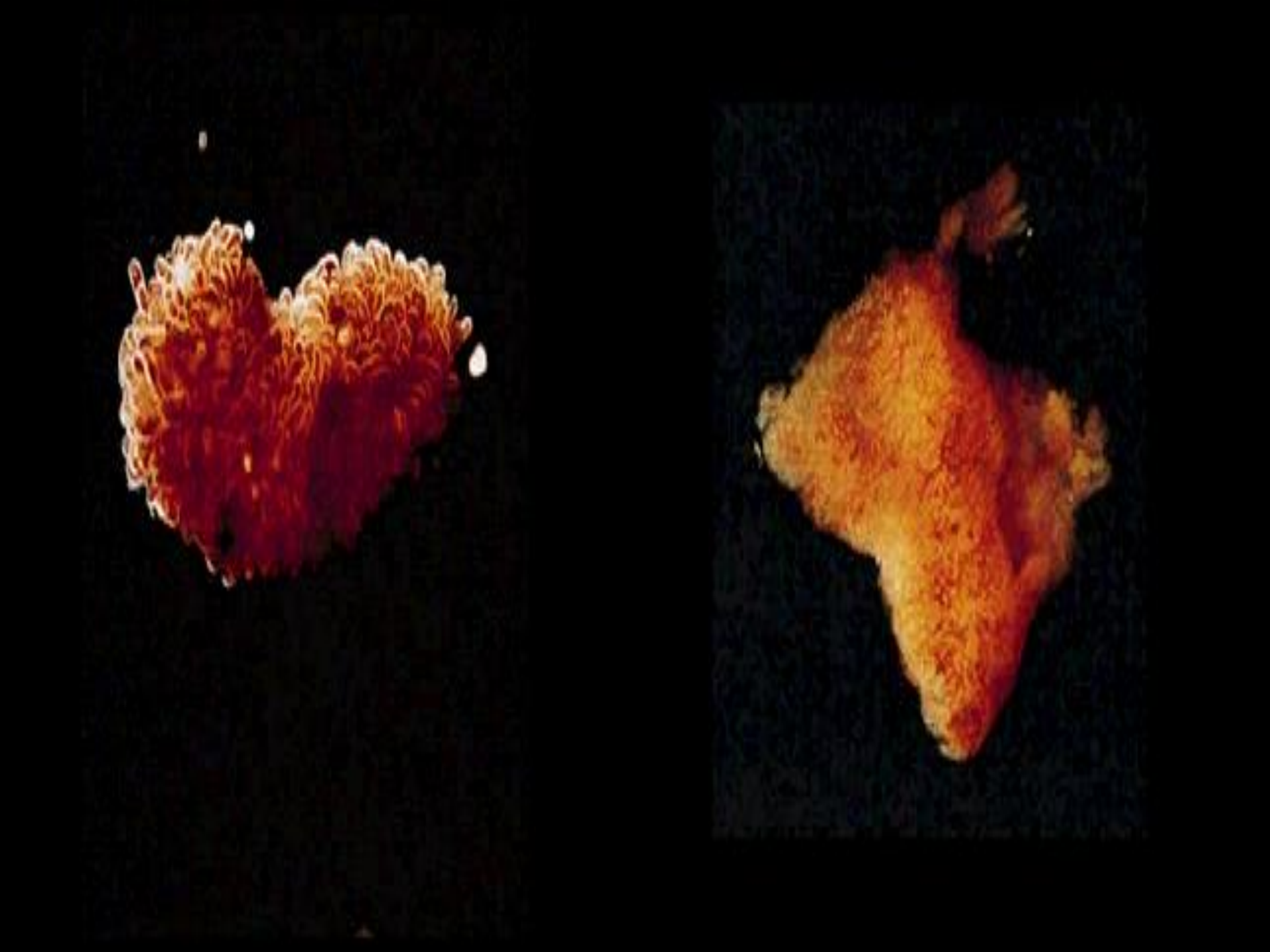
Investigations;

1- Duodenal or jejunal biopsy; an increase in mucosal lymphocytes and plasma cells (the infiltrative lesion) with partial blunting or total villous flattening.

2-Antibodies; Serum antigliadin (especially IgA) and Anti-endomysial antibodies IgA Ab.

3-Haematology and biochemistry; Microcytic or macrocytic anaemia from iron or folate deficiency , reduced concentrations of calcium, magnesium, total protein, albumin or vitamin D.

4-Barium follow-through; dilated loops of bowel, diminished folds , flocculation of contrast.





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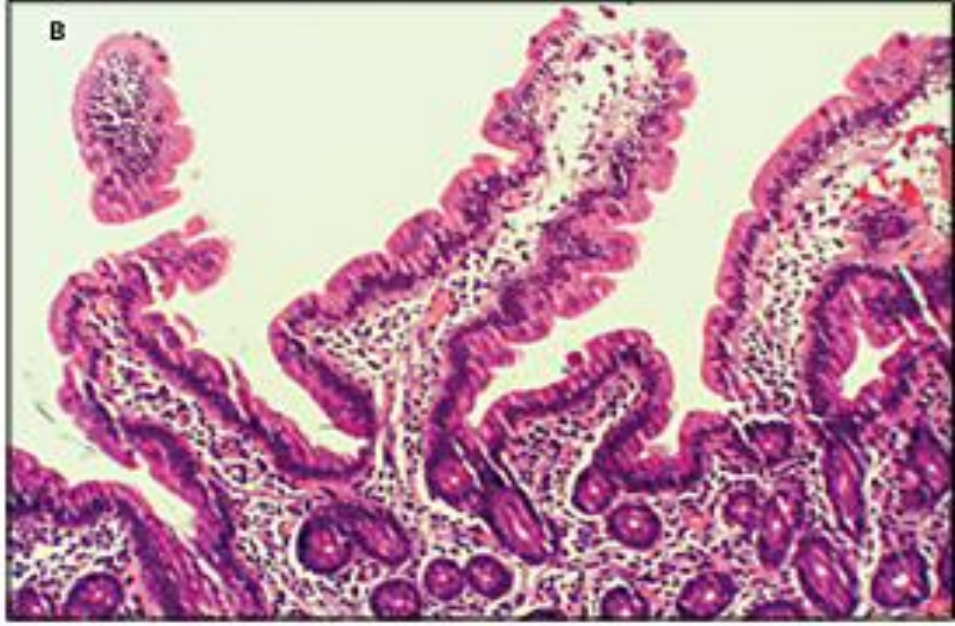
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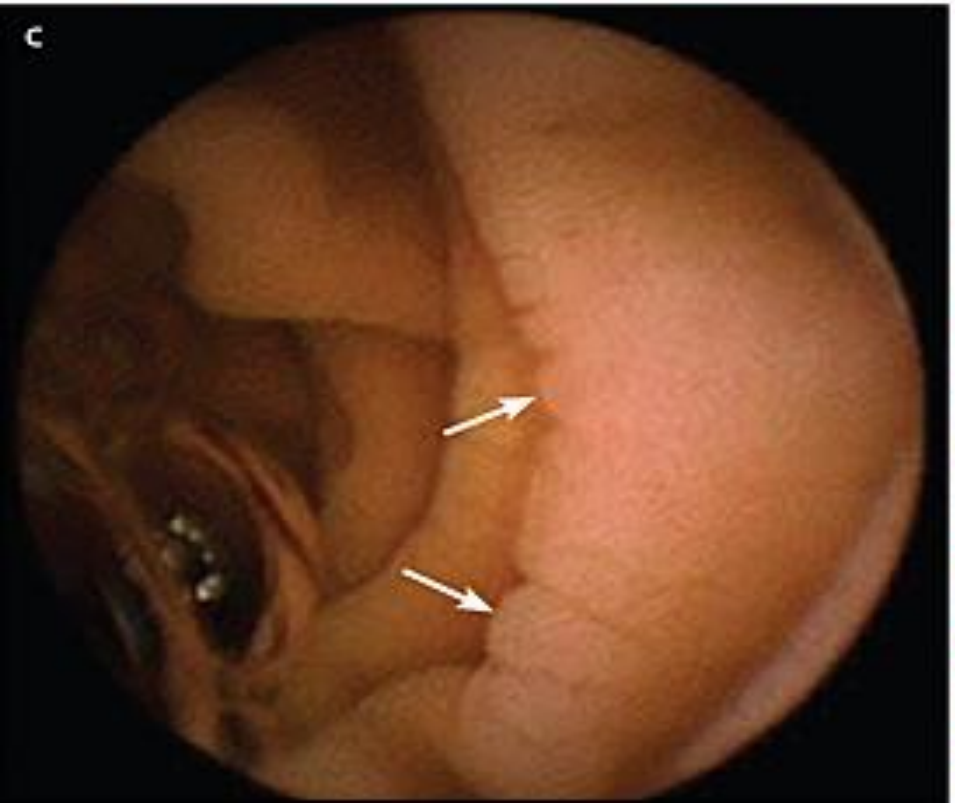
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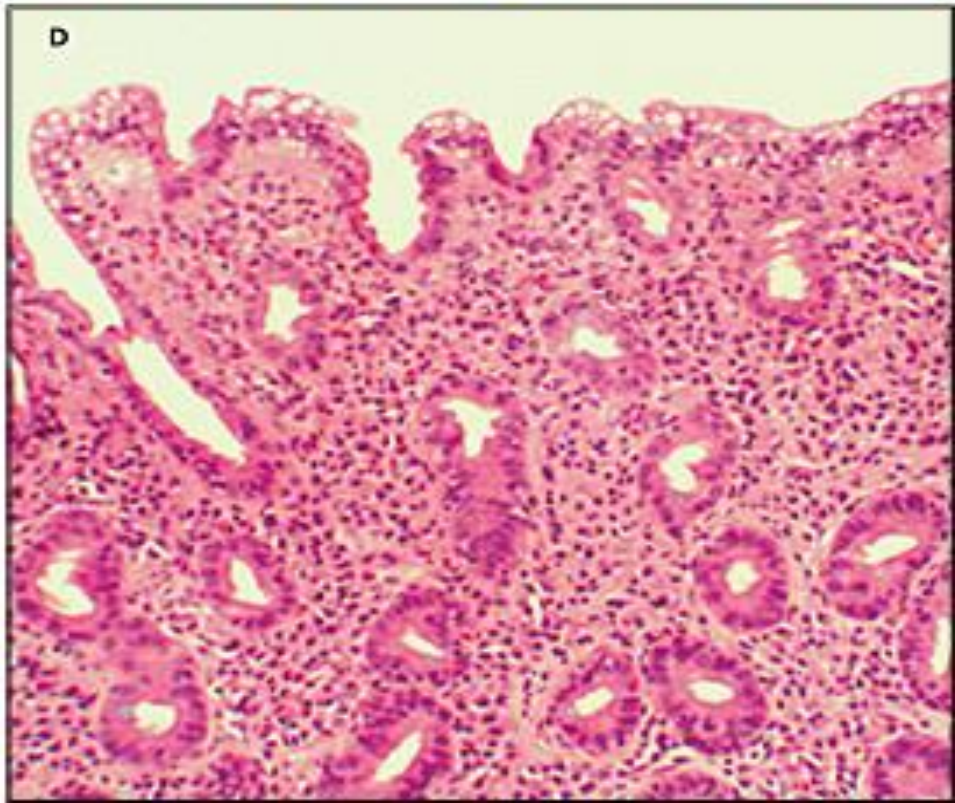
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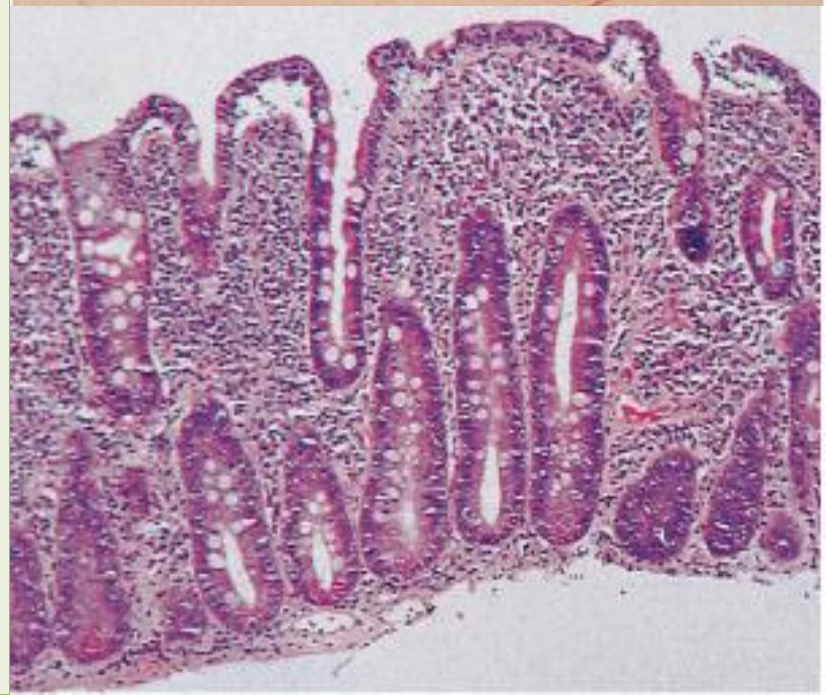
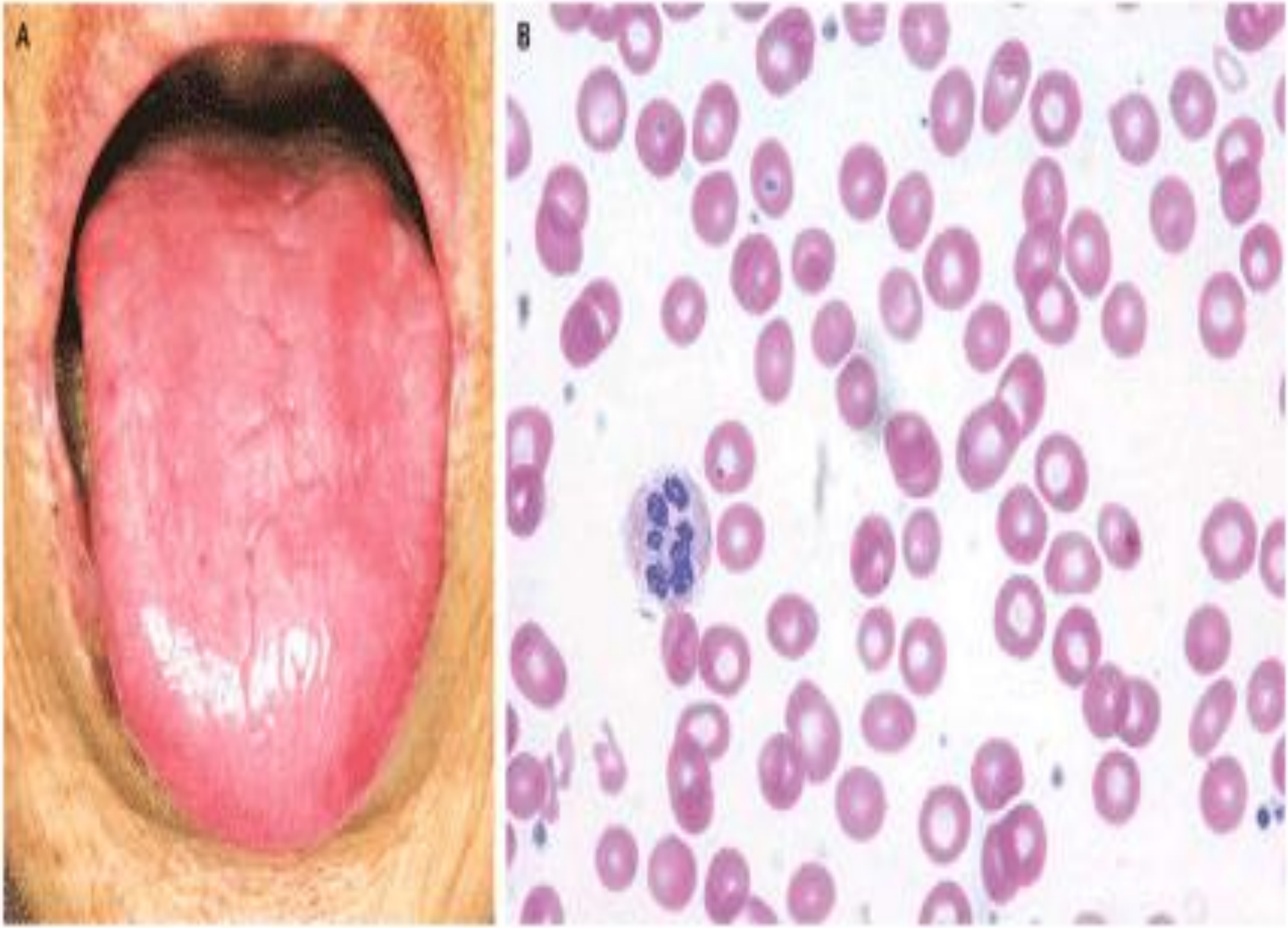
Important causes of subtotal villous atrophy

- Coeliac disease
- Tropical sprue
- Dermatitis herpetiformis
- Lymphoma
- AIDS enteropathy
- Giardiasis
- Hypogammaglobulinaemia
- Radiation
- Whipple's disease
- Zollinger-Ellison syndrome

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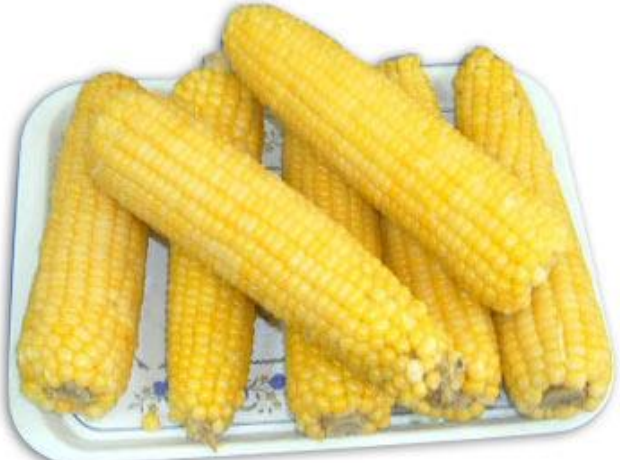
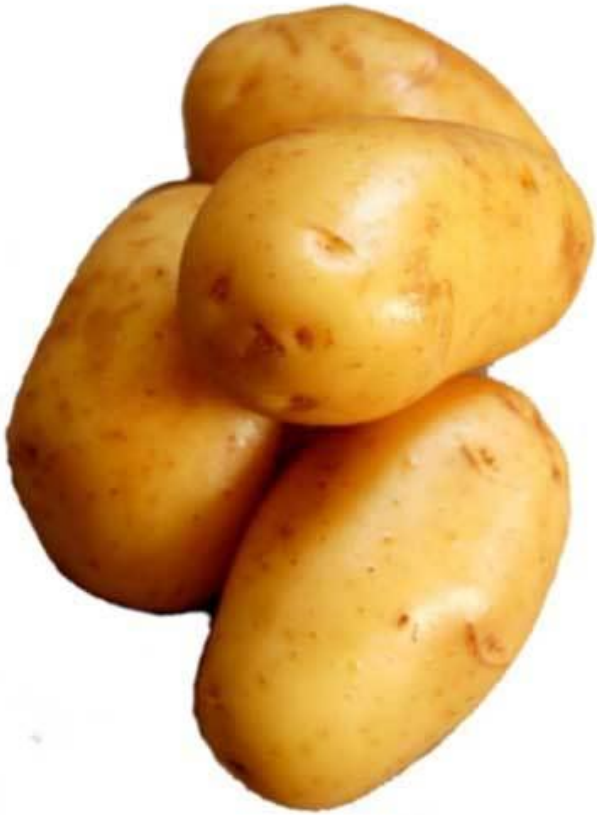
Management;

1-Correct existing deficiencies of iron, folate, calcium and/or vitamin D.

2-Commence a life-long gluten-free diet.

- Exclusion of wheat, rye, barley and initially oats
- Rice, maize and potatoes as a sources of carbohydrates.
- Booklets produced by coeliac societies.





Follow up;

1-Regular monitoring; of symptoms, weight and nutrition is essential.

2-Compliance to diet.

3-Good response; improve symptoms with disappearance of anti-endomysial antibodies.

4-Repeat jejunal biopsies; If symptoms do not improved or antibodies remain persistently positive.

Complications of celiac disease;

1- Intestinal lymphoma

2- Small bowel carcinoma

3- Squamous carcinoma of the oesophagus

4- Ulcerative jejunoileitis

DERMATITIS HERPETIFORMIS;

It is skin lesion characterised by crops of intensely itchy blisters over the elbows, knees, back and buttocks , due to IgA Ab deposition, associated with partial villous atrophy on jejunal biopsy, responds to a gluten-free diet.

TROPICAL SPRUE;

Chronic, progressive malabsorption in a patient in or from the tropic, associated with small intestinal infection. Tetracycline 250 mg 6-hourly for 28 days is the treatment of choice.

SMALL BOWEL BACTERIAL OVERGROWTH ('BLIND LOOP SYNDROME')

The count of coliform organisms in small intestine may be 10^8-10^{10}/ml organisms.

The normal contain less than 10^4/ml organisms .

Due to impair the normal physiological mechanisms controlling bacterial proliferation in the intestine.

ILEAL RESECTION;

Malabsorption that results from ileal resection, for example following surgery for Crohn's disease, that leads to Vitamin B_{12} and bile salt malabsorption.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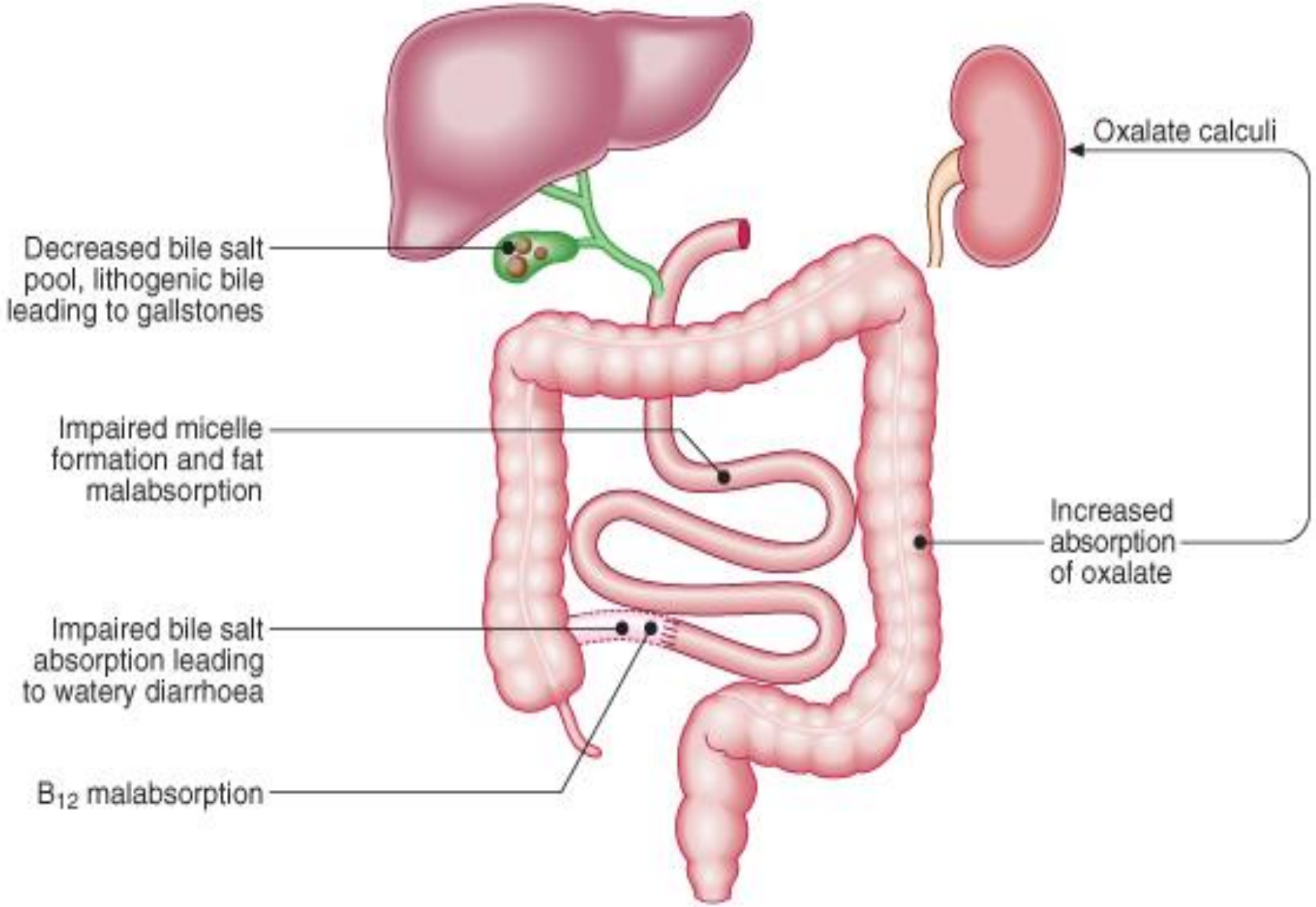

Consequences of ileal resection.

Thanks