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UNIVERZITY KARLOVY V PRAZE



MALABSORPTION SYNDROME LABORATORY DIAGNOSIS



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<http://gweb.zde.cz>



1.LF UK tutorial, July 2025



MALABSORPTION-MALDIGESCE-MALASIMILATION
GIT FUNCTIONS
EXAMINATION METHODS
COELIAC DISEASE - GLUTEN ENTEROPATHY
LACTOSE INTOLERANCE
PANCREATIC INSUFFICIENCY
SMALL INTESTINAL BACTERIAL OVERGROWTH

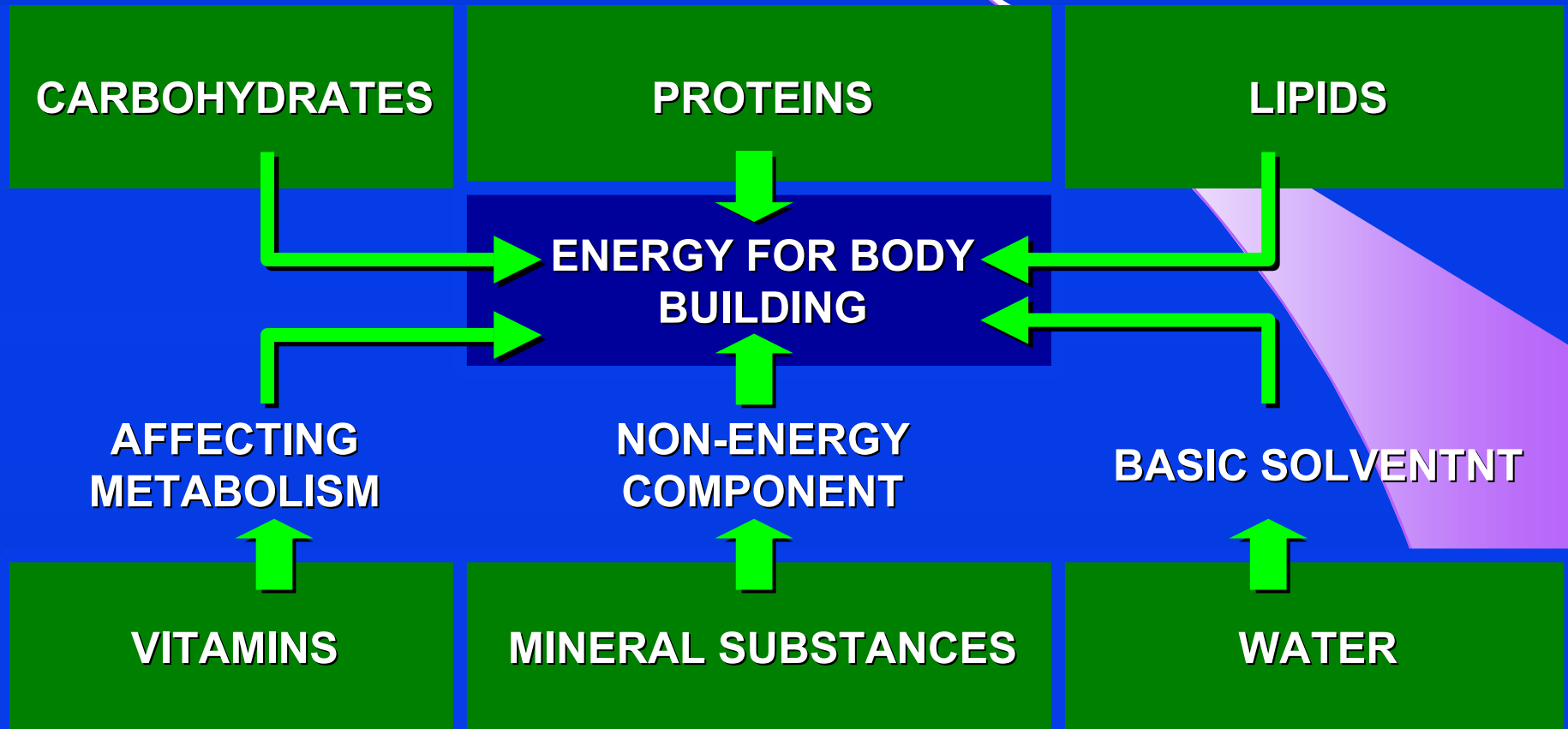


MALABSORPTION





BASIC COMPONENTS OF NUTRITION





MALABSORPTION, MALDIGESTION, MALASIMILATION

➤ **MALABSORPTION**

CONDITIONS IN WHICH THE ABSORPTION AND, IN A BROADER CONCEPT, THE DIGESTION OF FOOD IN THE DIGESTIVE TRACT ARE DISRUPTED

➤ **MALDIGESCE**

DISORDER OF DIGESTION CAUSED BY FAILURE OF VARIOUS ORGANS OF THE DIGESTIVE TRACT (STOMACH, PANCREAS, LIVER, INTESTINES), INCLUDING DEFICIENCY OF DIGESTIVE ENZYMES OR BILE. MALDIGESTION ALONG WITH MALABSORPTION IS SOMETIMES REFERRED TO AS MALASIMILATION.

➤ **MALASIMILATION**

DISORDER OF NUTRIENT UTILIZATION (ASSIMILATION), INCLUDES MALDIGESTION AND MALABSORPTION. SINCE DIGESTION IS A CONDITION FOR NUTRIENT ABSORPTION, MALDIGESTION RESULTS IN MALABSORPTION, WHICH OVERLAPS TO A SIGNIFICANT DEGREE WITH MALASIMILLATION



MALABSORPTION-MALDIGESCE-MALASIMILATION

GIT FUNCTIONS

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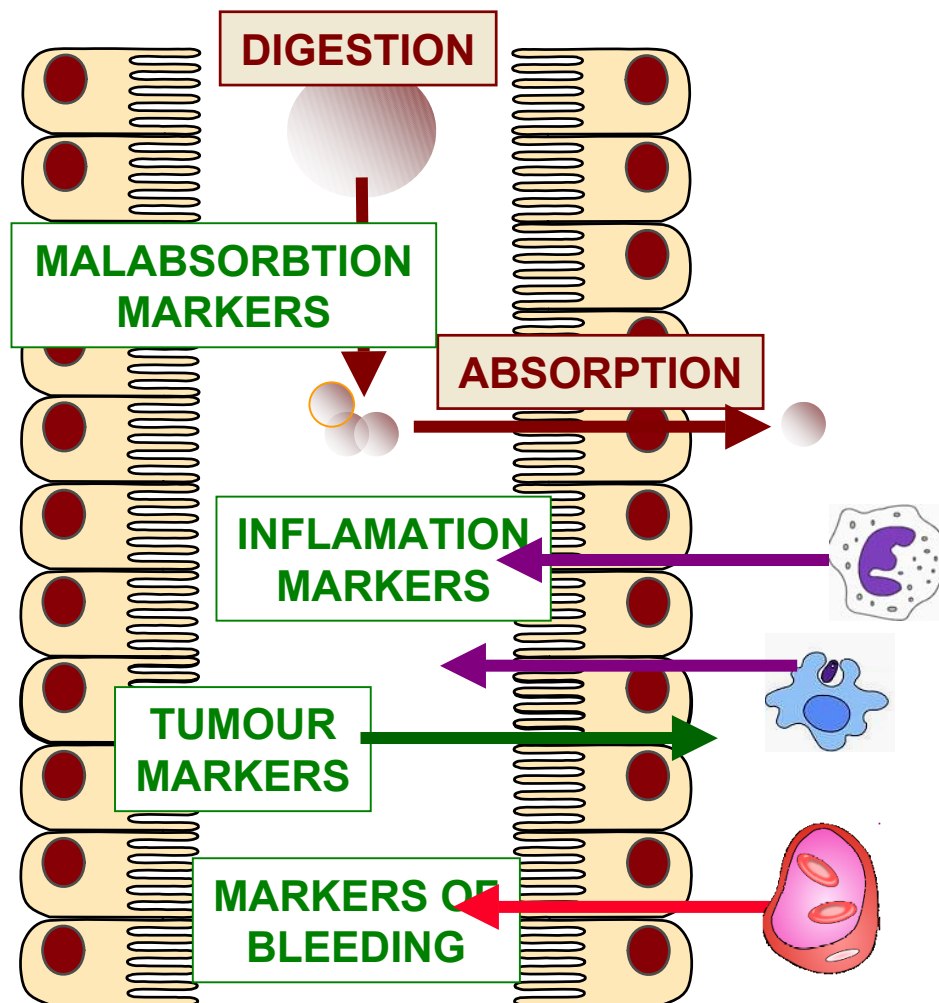
COELIAC DISEASE - GLUTEN ENTEROPATHY

LACTOSE INTOLERANCE

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α_1 -antitrypsin
Pancreatic elastase

PMN elastase
 β -defensin
Zonulin

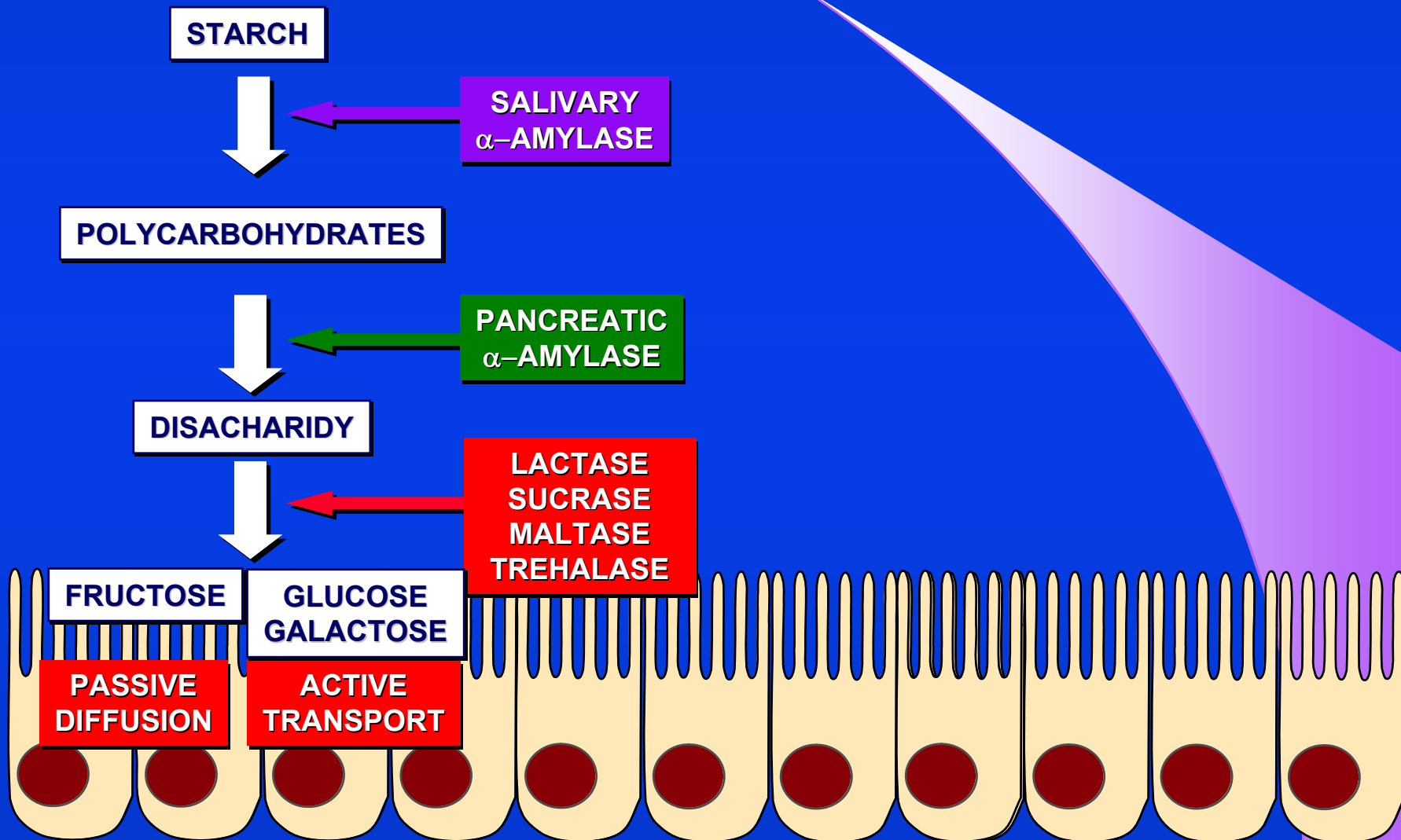
Calprotectin
Calgranulin
Lactoferrin
Neopterin

M2-protein kinase
DNA markers

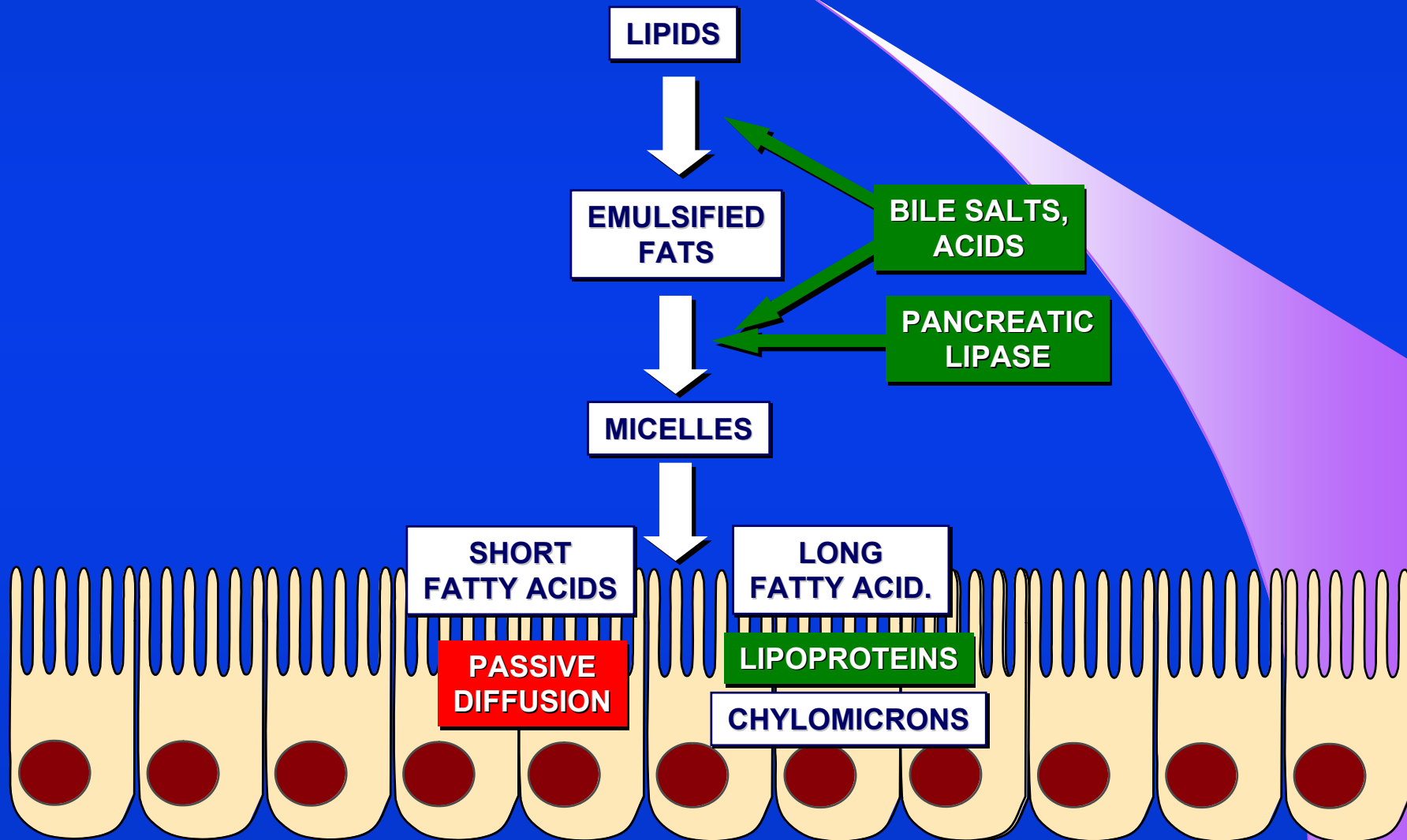
Haemoglobin
Haptoglobin
Transferrin



CARBOHYDRATE DIGESTION PROCESS

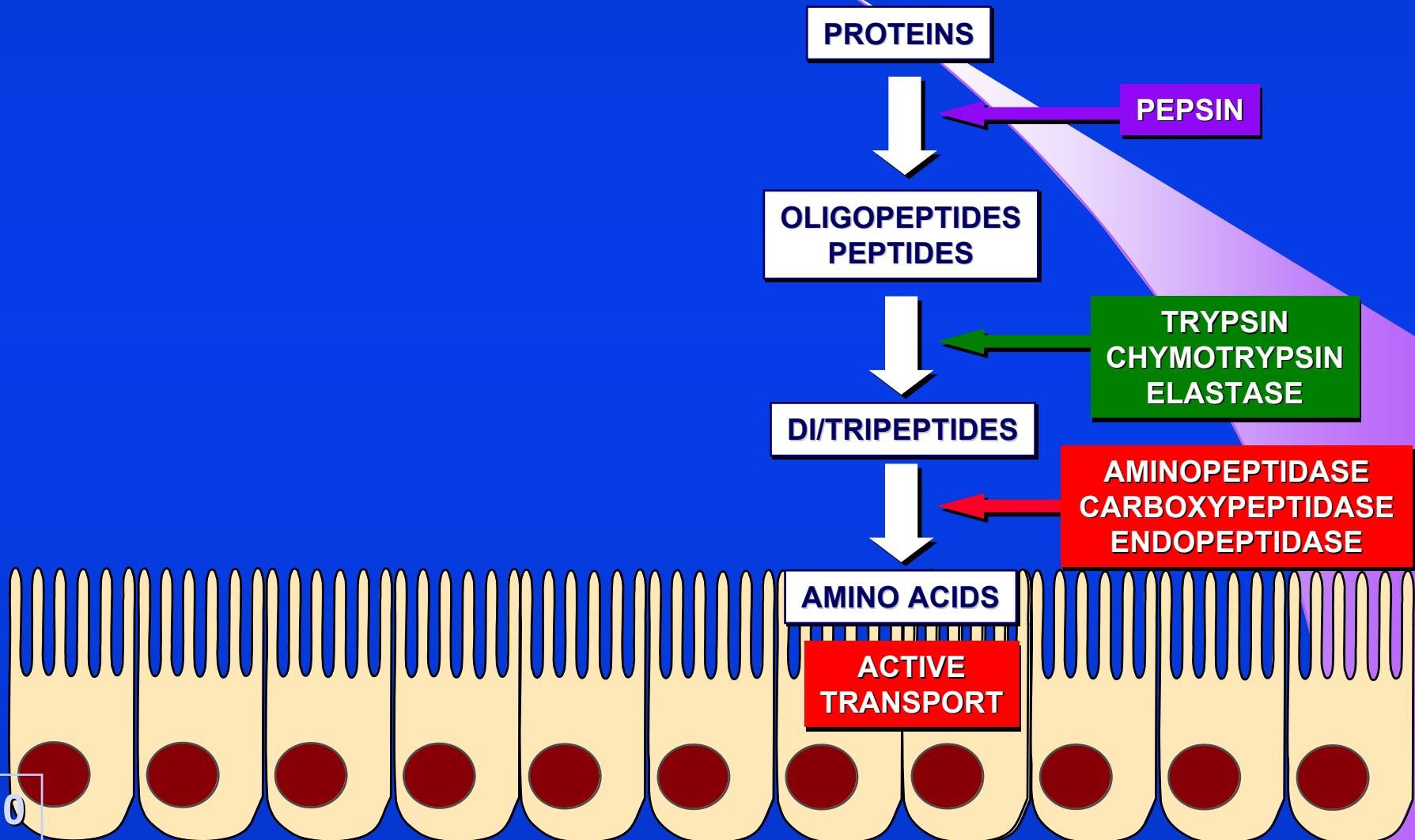


LIPID DIGESTION PROCESS





PROTEIN DIGESTION PROCESS

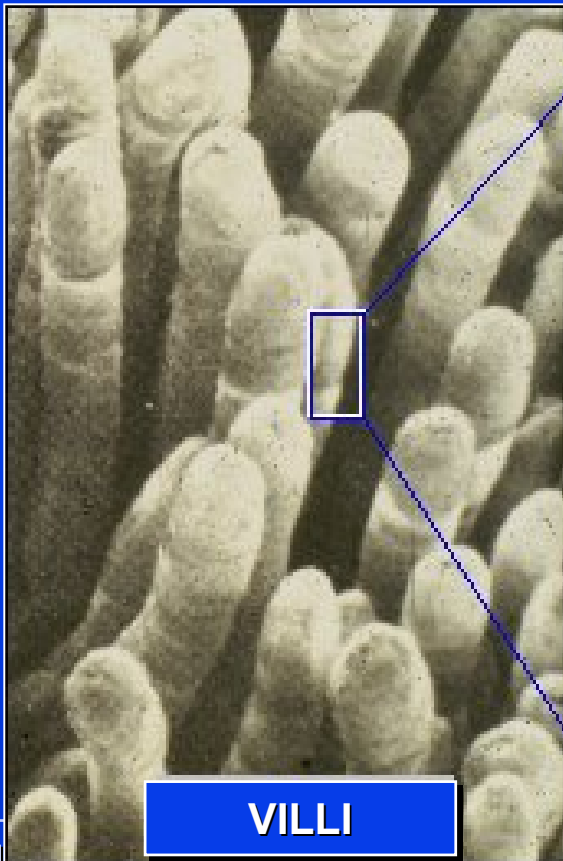


SMALL INTESTINE

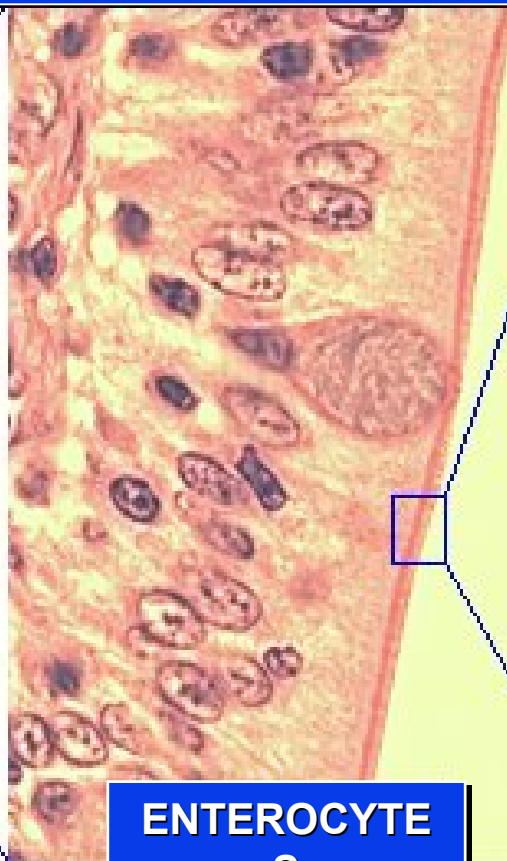
DUODENUM - JEJUNUM - ILEUM, LENGTH 3 - 4 METERS

SURFACE 5 x ENLARGE BY VILLI (0.5 - 1 mm, 20 - 40 villi / mm²)

MICROVILLI - BRUSH BORDER - ENLARGE THE SURFACE 30x - **100 m²**



VILLI



ENTEROCYTES



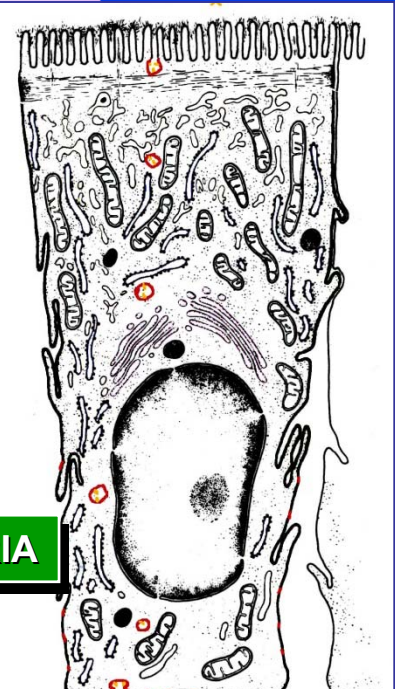
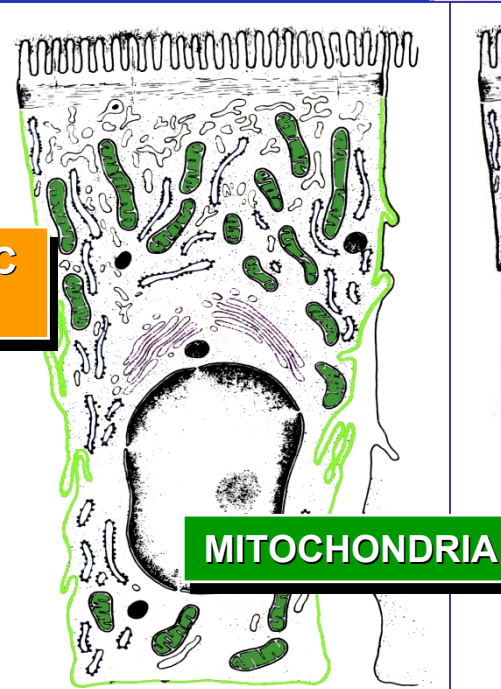
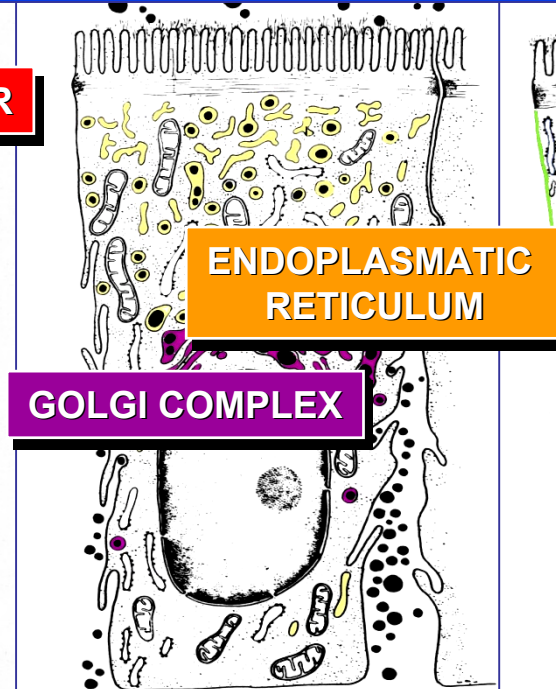
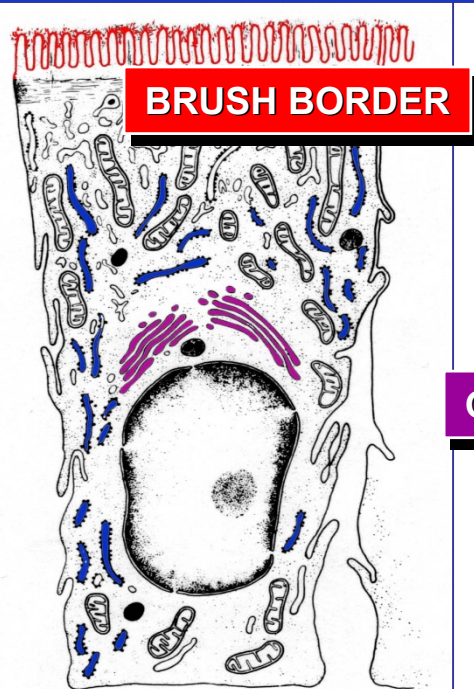
MICROVILLI

SMALL INTESTINE - ENTEROCYTE FUNCTION

ENZYMES
BRUSH BORDER
PEPTIDE CLEAVAGE
DISACCHARIDE

MEMBRANE DIFFUSION
AMINO ACIDS
MONOSACCHARIDES

TRANSEPITHELIAL
TRANSPORT
PROTEINS, IgA



DIGESTION

ABSORPTION

TRANSPORT



MALABSORPTION, MALDIGESTION, MALASIMILATION

➤ **MALABSORPTION**

A STATE OF DEFICIENCY OF ONE OR MORE ESSENTIAL NUTRIENTS IT IS NOT DIGESTED AND ABSORBED, OR IS NOT SUFFICIENTLY DIGESTED

➤ **MALABSORPTION SYNDROME (MS) INCLUDES:**

- DISORDER OF INTRALUMINAL DIGESTION,
- DIGESTION NUTRIENT ABSORPTION DISORDER,
- ABNORMAL SECRETION OF DIGESTIVE JUICES
- SERIOUS MOTILITY DISORDER
- INSUFFICIENT FOOD INTAKE

➤ **PRIMARY MALABSORPTION SYNDROME**

DISORDER AT THE LEVEL OF THE ENTEROCYTE
CELIAC DISEASE, TROPICAL SPRUE, WHIPPLE'S DISEASE

➤ **SECONDARY MALABSORPTION SYNDROME**

DISEASE OF THE PANCREAS, GALLBLADDER, LIVER,
OBSTRUCTIVE INTESTINAL DISEASES, INFECTION



MALABSORPTION - CLINICAL MANIFESTATIONS

FATS
FATTY ACIDS
BILE SALTS



STEATORRHOEA
DIARRHEA

PROTEINS
SUGARS



MUSCLE WEAKNESS, FATIGUE
WEIGHT LOSS

LACTOSE



MILK INTOLERANCE

IRON
CALCIUM



ANEMIA



PATHOLOGICAL FRACTURES

VITAMIN B12, FOLATES



MEGALOBLASTIC ANEMIA

VITAMIN K



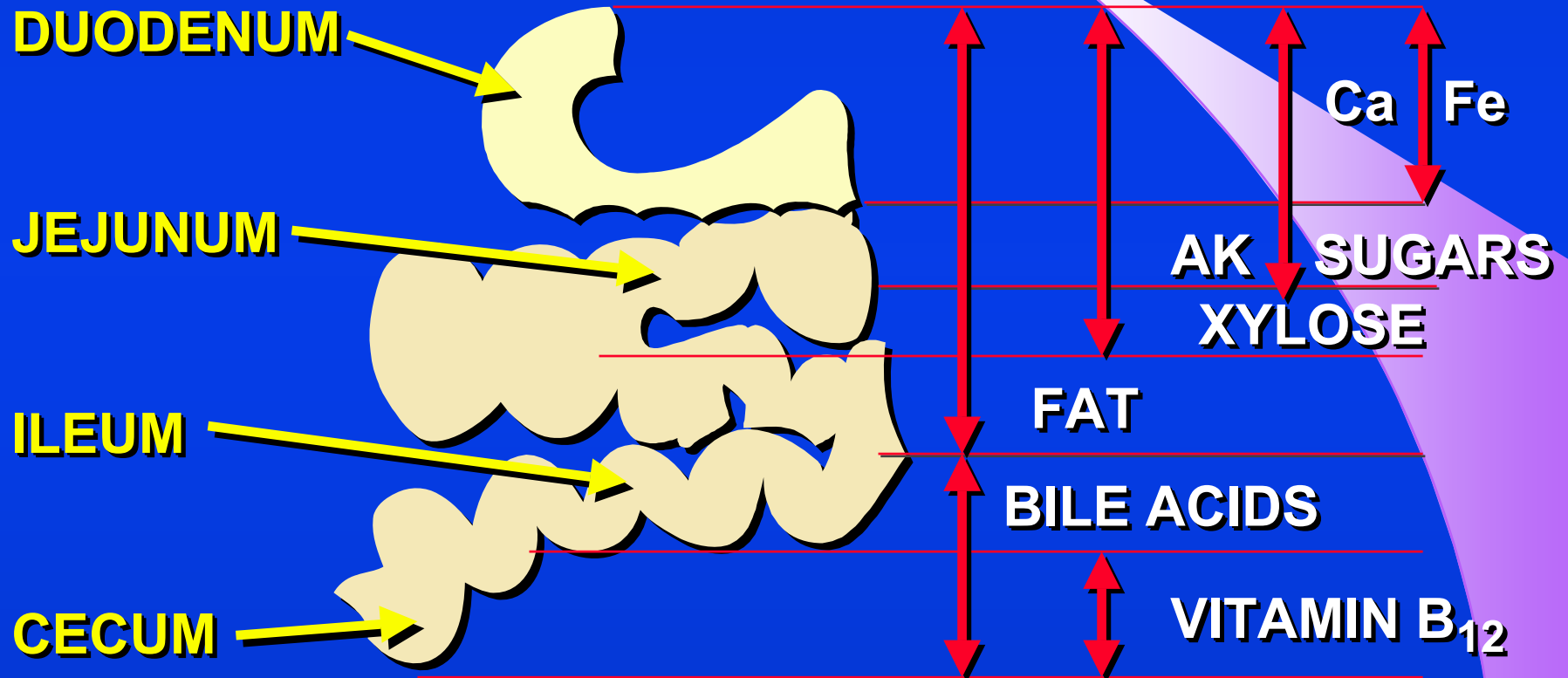
BLEEDING

VITAMIN D, Ca, Mg



NEUROLOGICAL SY., TETANIA

RESORPTION AND ABSORPTION FROM THE SMALL INTESTINE





MALABSORPTION-MALDIGESCE-MALASIMILATION GIT FUNCTIONS

EXAMINATION METHODS

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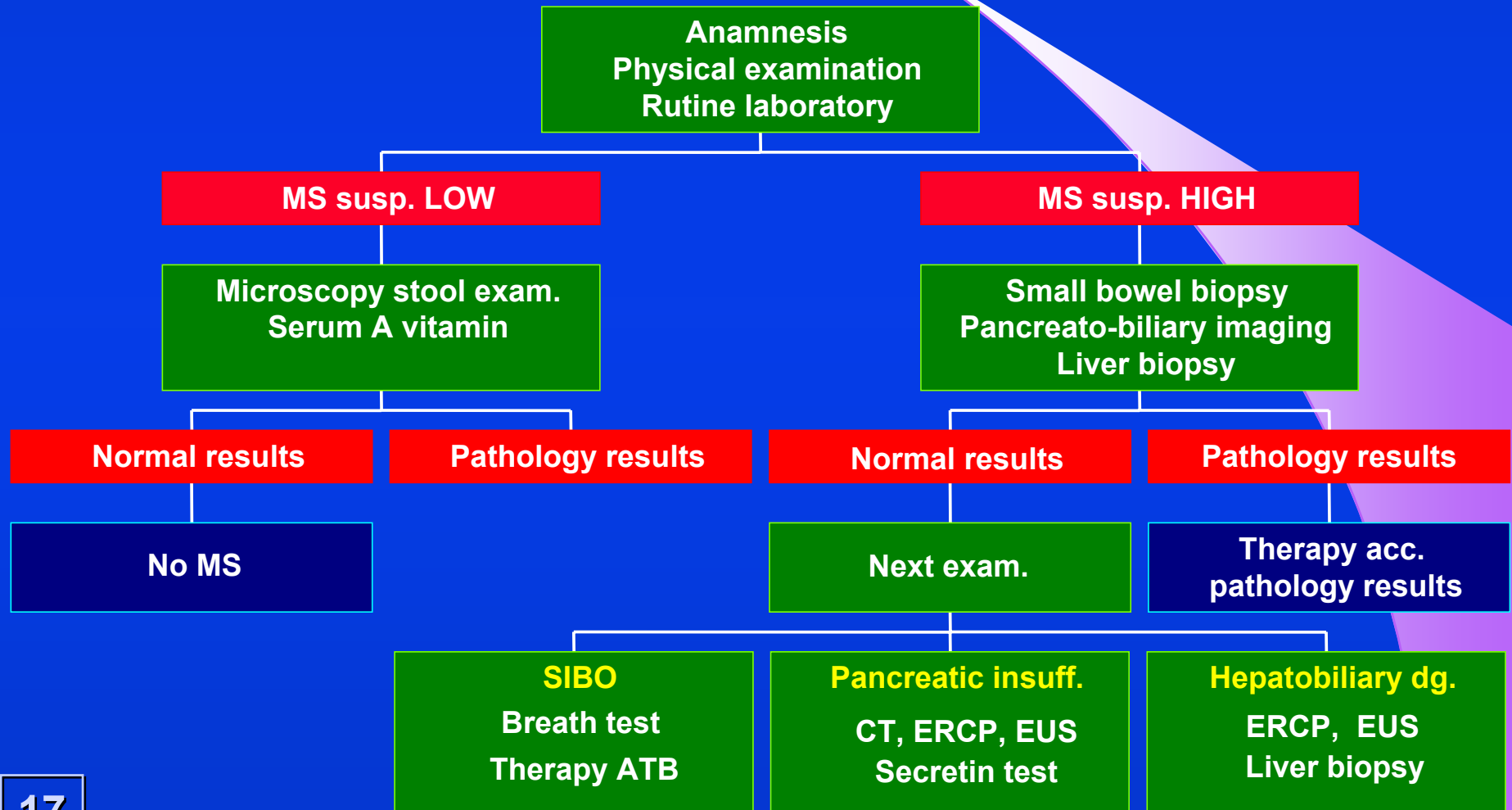
PANCREATIC INSUFFICIENCY

SMALL INTESTINAL BACTERIAL OVERGROWTH

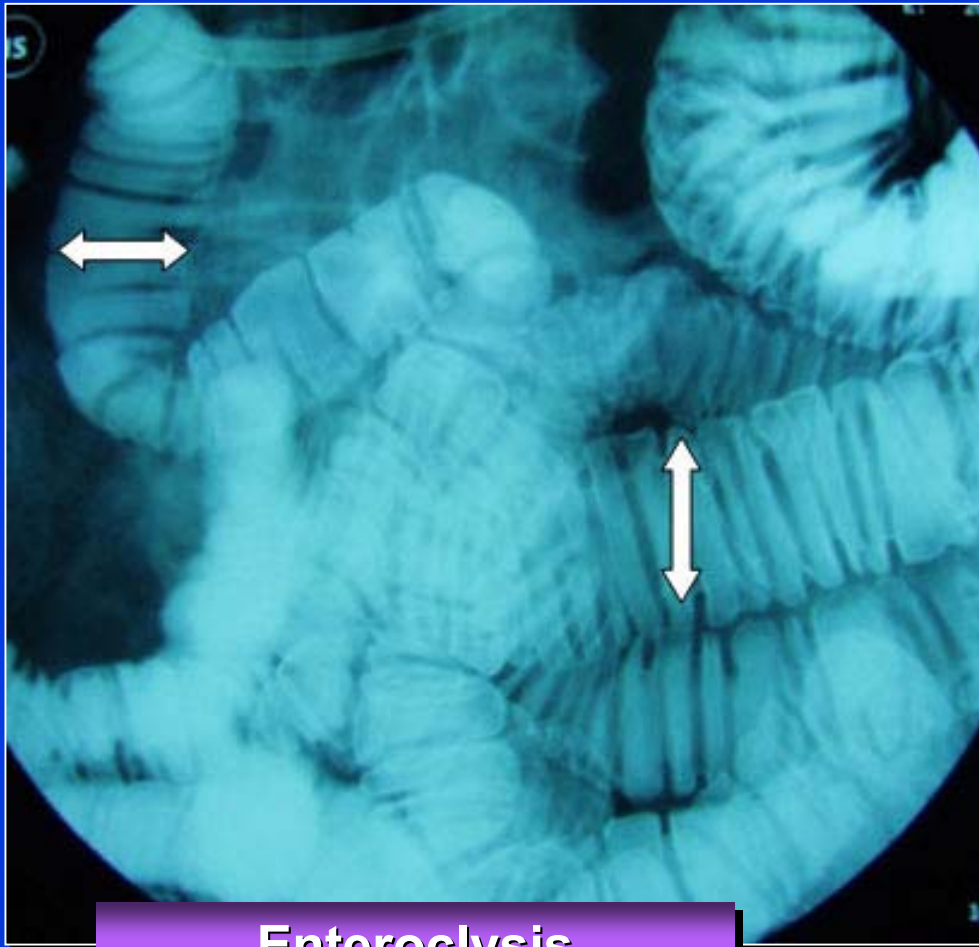




DIAGNOSTIC ALGORITHM FOR MALABSORPTION



X RAY EXAMINATION



Enteroclysis

Contrast examination

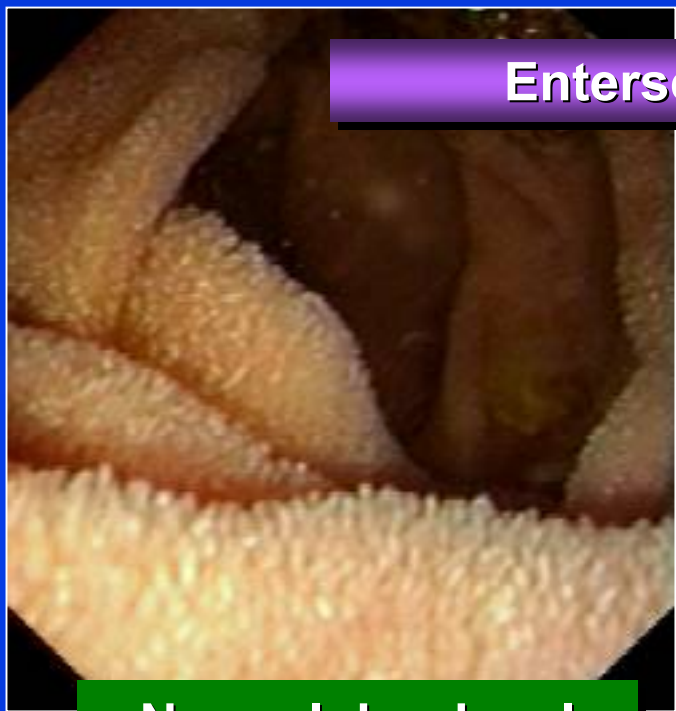


Stomach

Small Bowel

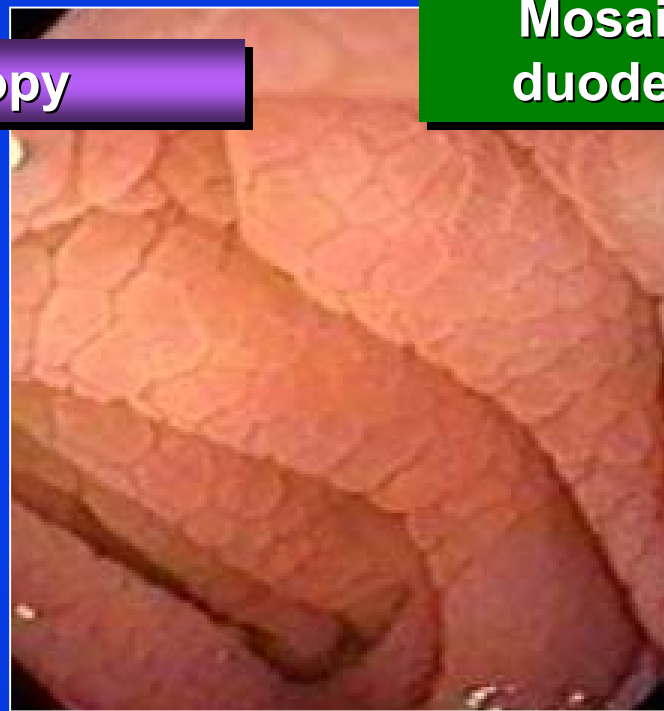
ENDOSCOPY EXAMINATION

Enterscopy



Normal duodenal
mucosa

Mosaic pattern of
duodenal mucosa



Chromoendoscopy
with indigocarmine

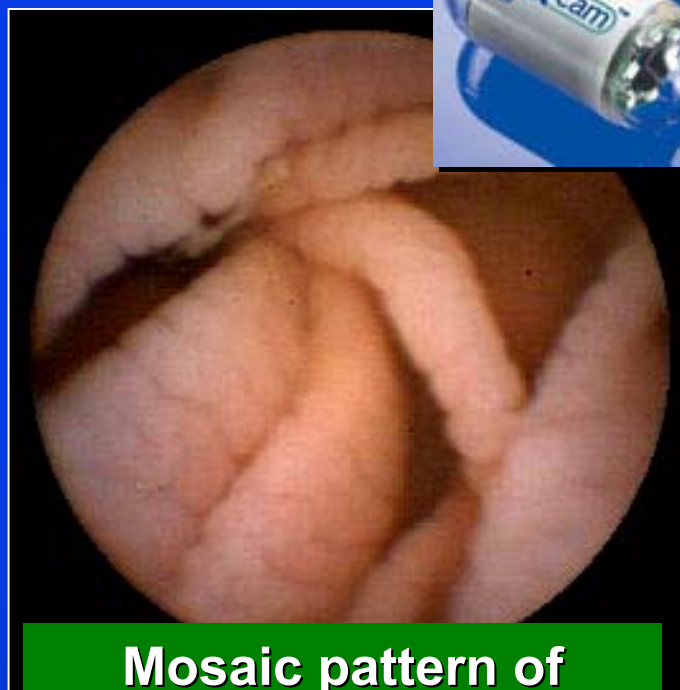


CAPSULE ENDOSCOPY

NON-INVASIVE ENDOSCOPIC EXAMINATION

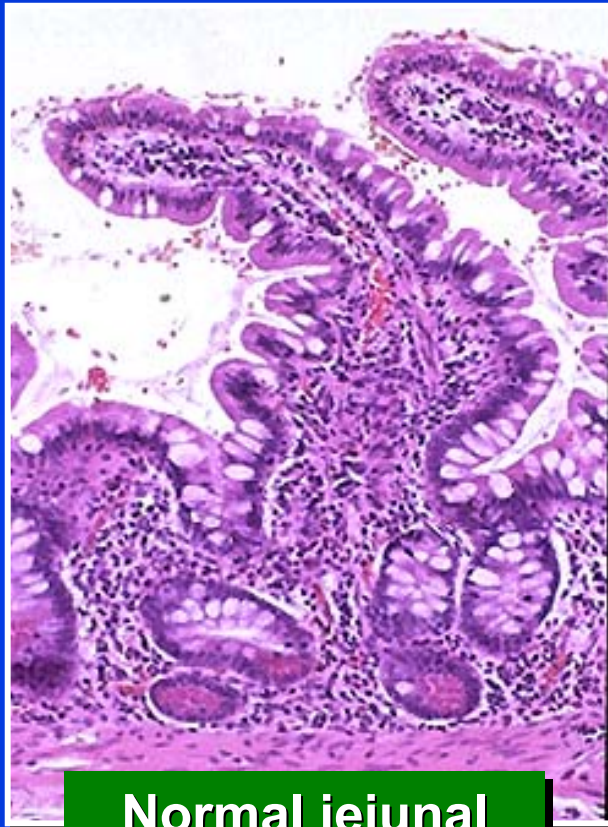


**Normal duodenal
mucosa**

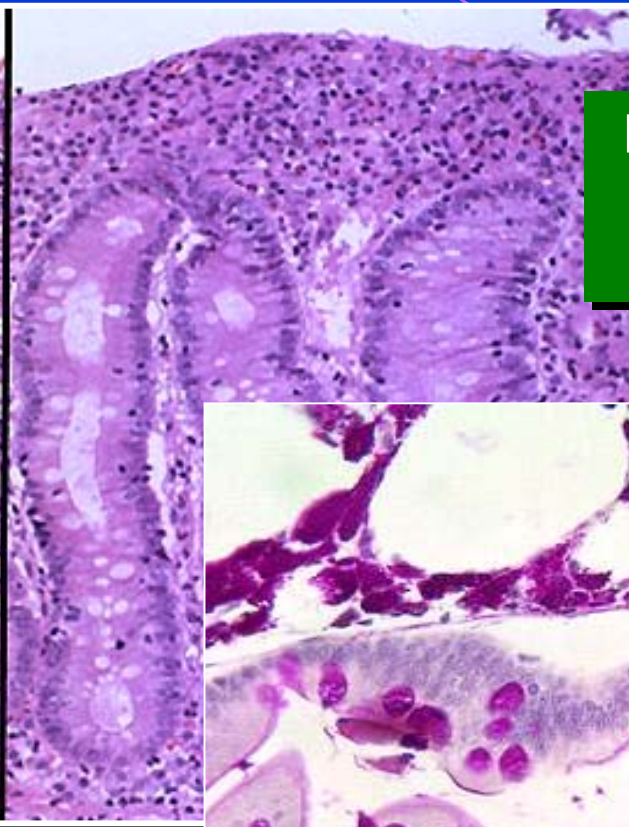


**Mosaic pattern of
duodenal mucosa**

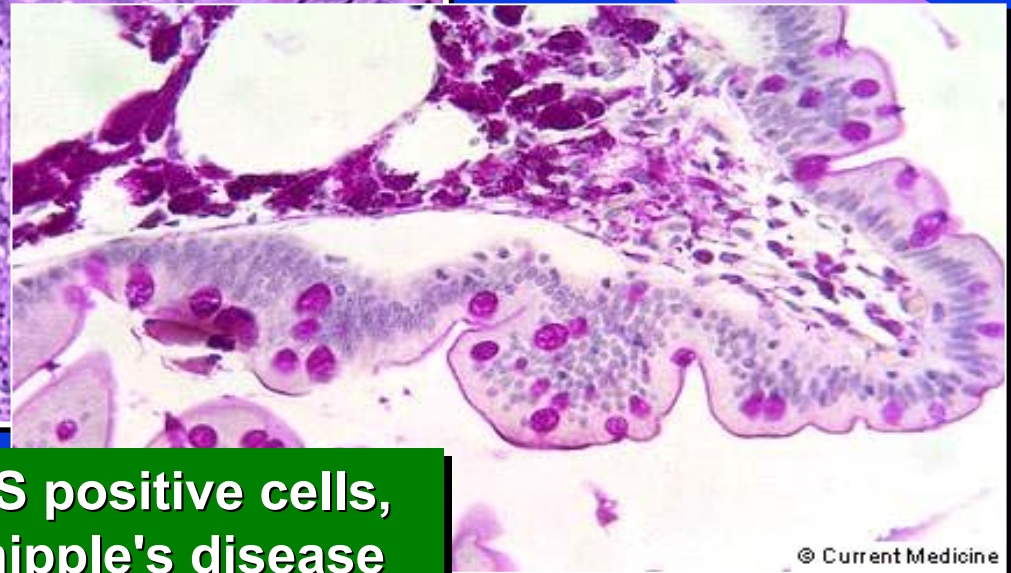
HISTOLOGICAL EXAMINATION OF BIOPSY - MUCOSA



**Normal jejunal
mucosa**



**Flat, atrophic mucosa,
crypt hyperplasia,
celiac disease**



**PAS positive cells,
Whipple's disease**

© Current Medicine



STOOL EXAMINATION

ANALYSIS OF FECES ENABLES THE DIAGNOSTIC PROCESS OF DISEASES OF THE DIGESTIVE SYSTEM, LIVER AND PANCREAS. CLARIFICATION OF THE CAUSES LEADING TO SYMPTOMS AFFECTING THE GI tract INCLUDING DIARRHEA, NAUSEA, VOMITING, EDEMA, PAIN, SPASMS, FEVER, LOSS OF TASTE, ETC.

- DETECTION OF SOME **ENZYMES IN THE FECES** TO DETERMINE THE RATE OF PANCREATIC FUNCTION.
- DETECTION OF **OCCULT BLEEDING** FOR COLORECTAL TUMOR SCREENING
- DETECTION OF THE PRESENCE OF **PARASITES**, E.G. LAMBLIA
- DETECTION AND IDENTIFICATION OF SOME TYPES OF **BACTERIA**
- DETECTION OF **UNDIGESTED FOOD REMAINS** IN MALABSORPTION SYNDROME

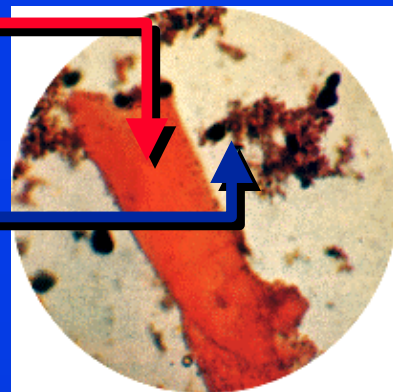
MICROSCOPIC EXAMINATION OF STOOL

*Gastroenterologie für die Praxis
München, 1975*

**MUSCLE
FIBRES**

**STARCH
GRAIN**

**FAT
DROPLET**



**NATIVE PREPARATION
LEFTOVERS OF FOOD
CELLULOSE FIBER**

FRIEDIGER'S REAGENTS STAINING
- MUSCLE FIBERS RED
- FAT DROPLETS YELLOW
- DARK BLUE STARCH GRAINS



BIOCHEMICAL EXAMINATIONS OF THE STOOL SAMPLE

Anti tTG IgA

Anti Gliadin sclgA

β -Defensin 2

Zonulin

α_1 -antitrypsin

Gliadin-33mer

Bile acids

Calprotectin

Lactoferrin

Haemoglobin

Haptoglobin

Transferrin

Helicobacter pylori Ag

Amylase

Lipase

Chymotrypsin

Elastase - 1

Lysozyme

Albumin

Myeloperoxidáza

PMN Elastase

EDN Eosi.Deriv.Neurotoxin

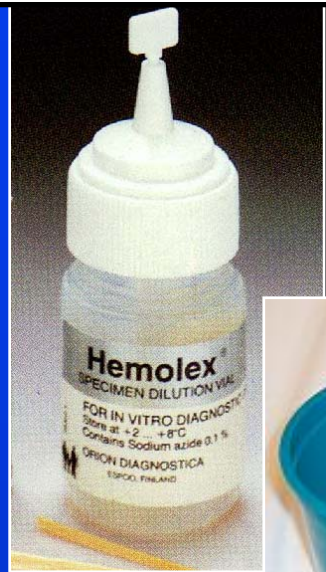
PCR / DNA



Fecal markers	Indication	Sensitivity	Specificity
Biomarkers IBD / IBS			
Calprotectin	IBD monitoring	70 - 100 %	70 - 100 %
S100 protein	IBD inflam. marker	60 - 67 %	70 - 90 %
Lactoferrin	Dif.diagnostics IBD - IBS	67 - 85 %	90 - 100 %
Biomarkers of cell turnover			
M2 - PK	Screening GE tumours	67 - 93 %	88 - 92 %
Biomarkers of digestion and malabsorption			
Elastase EL-1	Pancreatic insufficiency	100 %	96 %
Fecal fat	Liver, small bowel dg.	70 - 94 %	80 - 99 %
α_1 -antitrypsin	Protein enteropathy	60 - 78 %	80 - 85 %

Update on clinical and research application of fecal biomarkers for gastrointestinal diseases. Siddiqui I, Majid H, Abid S. World J Gastrointest Pharmacol Ther. 2017; 8(1): 39-46

STOOL EXAMINATION - SAMPLE COLLECTION





AUTOMATIC ANALYZERS FOR STOOL ANALYSIS



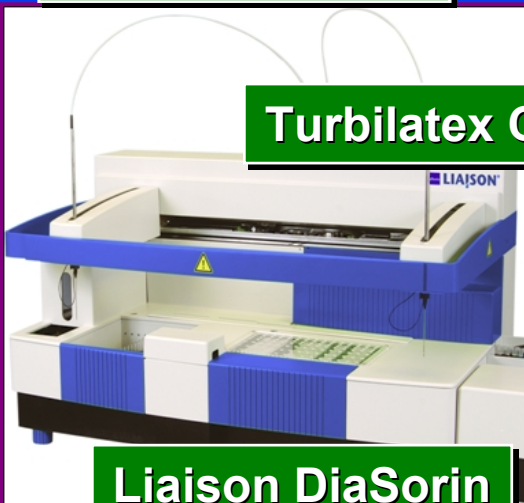
OC-Pledia Eiken

Hp ANTIGEN
HAEMOGLOBIN
CALPROTECTIN
TRANSFERRIN

OC-Ceres Eiken



Senti-FIT 270 Sentinel



Liaison DiaSorin

Turbilatex Cer Test



Kroma iT Linear



AVE 562 - AVE Tech.



AA01 Alfresa Pharma

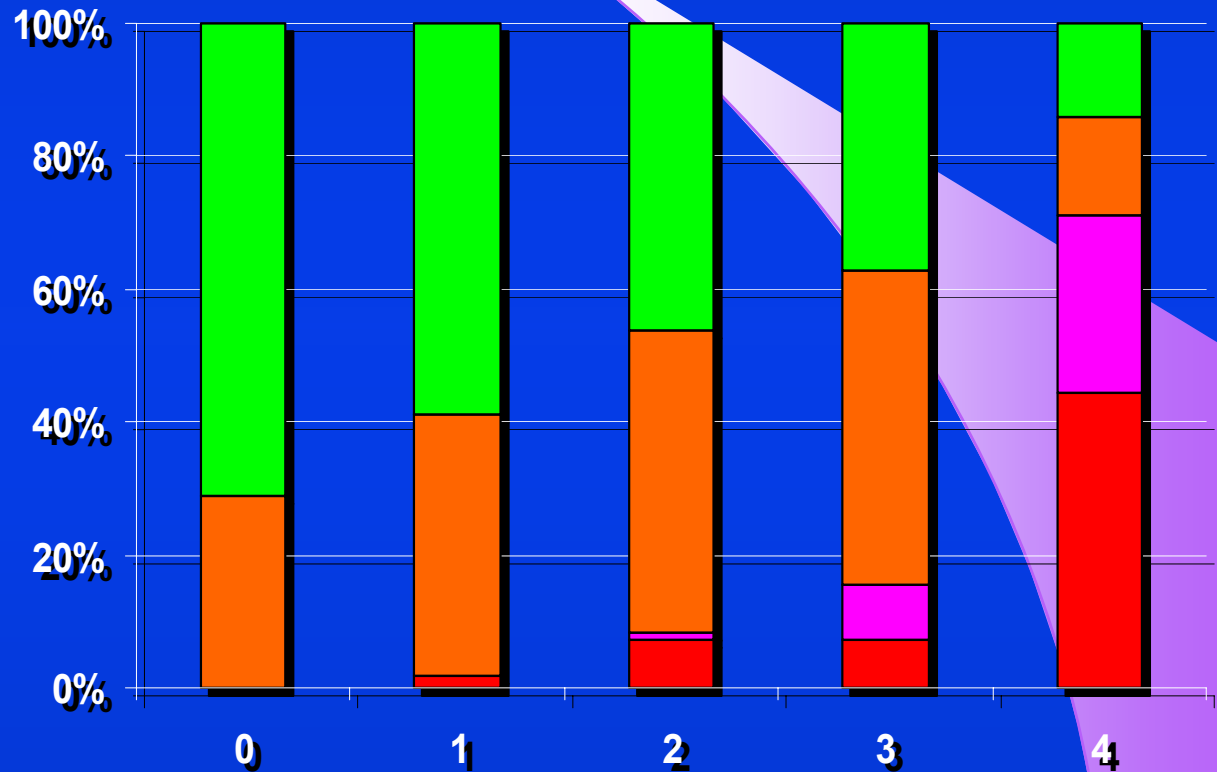




COMBINATION OF 4 MARKERS - POCT SCREENING

Colonoscopy findings for 0-4 positive tests. **CRC**, **IBD**, **GIT pathology**, **health**

Spanish study,
hemoglobin, transferrin,
calprotectin and
lactoferrin, highest
negative predictive
values: 94.8% for
significant pathologies
and 100% for CRC or IBD
if all 4 markers were
negative
(36.8% of patients)



A Point-of-Care Faecal Test Combining Four Biomarkers Allows Avoidance of Normal Colonoscopies and Prioritizes Symptomatic Patients with a High Risk of Colorectal Cancer. Hijos-Mallada G, Saura N, Lué A. et al. Cancers (Basel). 2023; 15(3): 721



QUANTITATIVE ANALYSIS OF FATS IN STOOL

REFERENCE METHOD
EXOCRINE FUNCTIONS OF THE PANCREAS

COLLECTION OF
STOOLS FOR 72 hr

FAT 72 hr.

S-CCK TEST



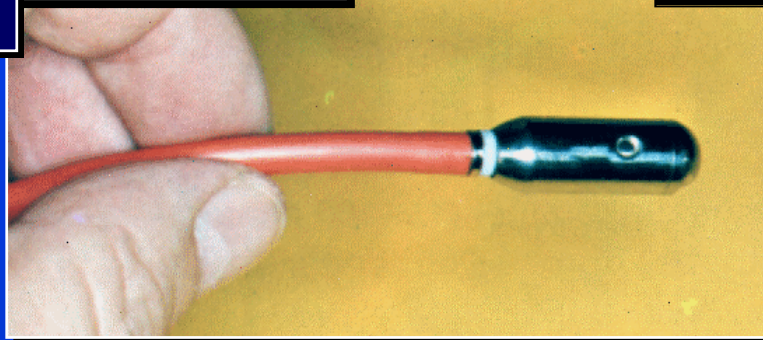
GASTRIC, DUODENAL, INTESTINAL BIOPSY



**GASTRIC PROBE
TYPE LEVIN**

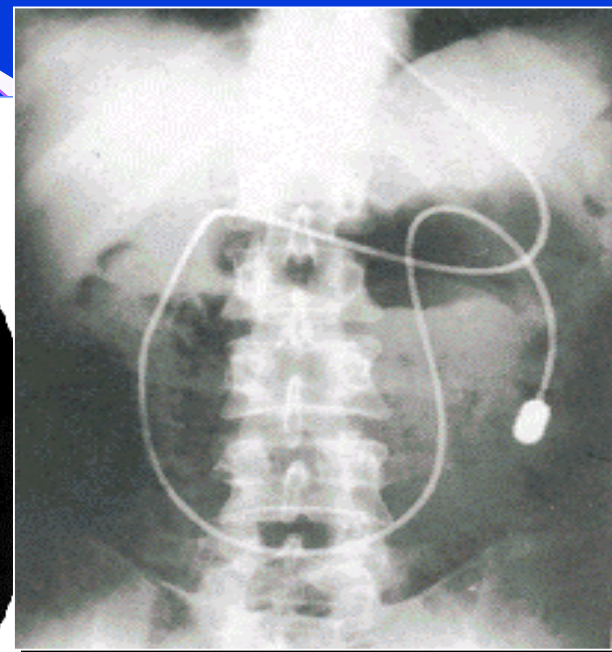
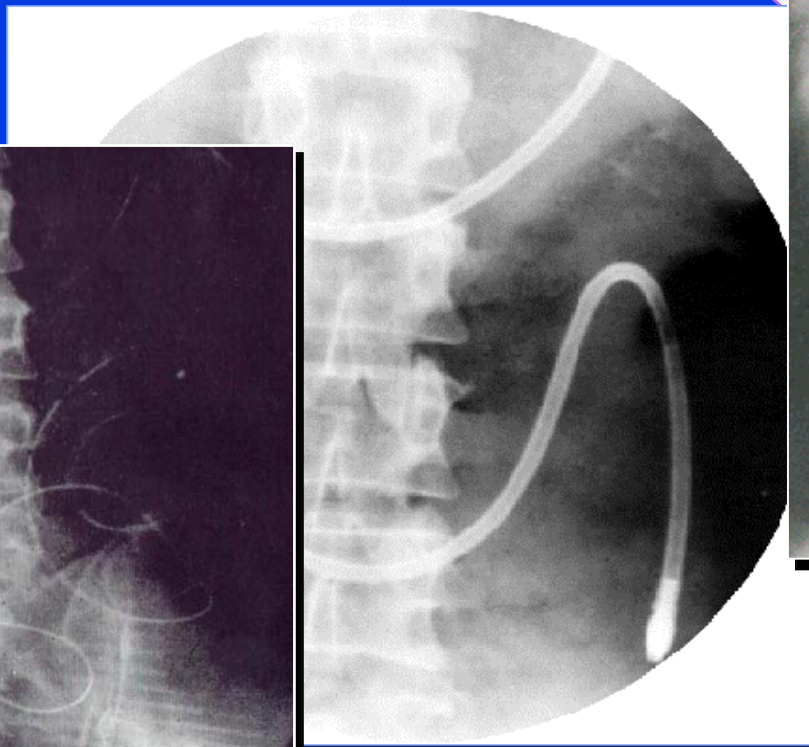


**CROSBY
CAPSLE**





X-RAY CHECK OF PROBE POSITION



HYDROGEN / METHANE - LACTOTEST-202 XTEND

ABSORBER
water and CO₂

SAMPLING BAG





HYDROGEN / METHANE BREATH TESTS

Breath test for SIBO, 75g glucose,
Breath samples are taken every 15 minutes for 3 hours
Breath test for lactose/fructose intolerance
20g lactose / 25g fructose
Breath samples are taken every 15 minutes for 4 hours
Test positivity – H_2/CH_4 rise of 10ppm against basal value

CLINICAL RESULTS:

NUMBER OF BREATH TESTS: 2300 x

SUSPECTED SIBO 80.4% of tests

POSITIVITY – 39.3%

SUSPECTED MALABSORPTION 19.6% of tests

POSITIVITY – 55.0%



H_2 / CH_4 BREATH TESTS, INDICATIONS, RELIABILITY

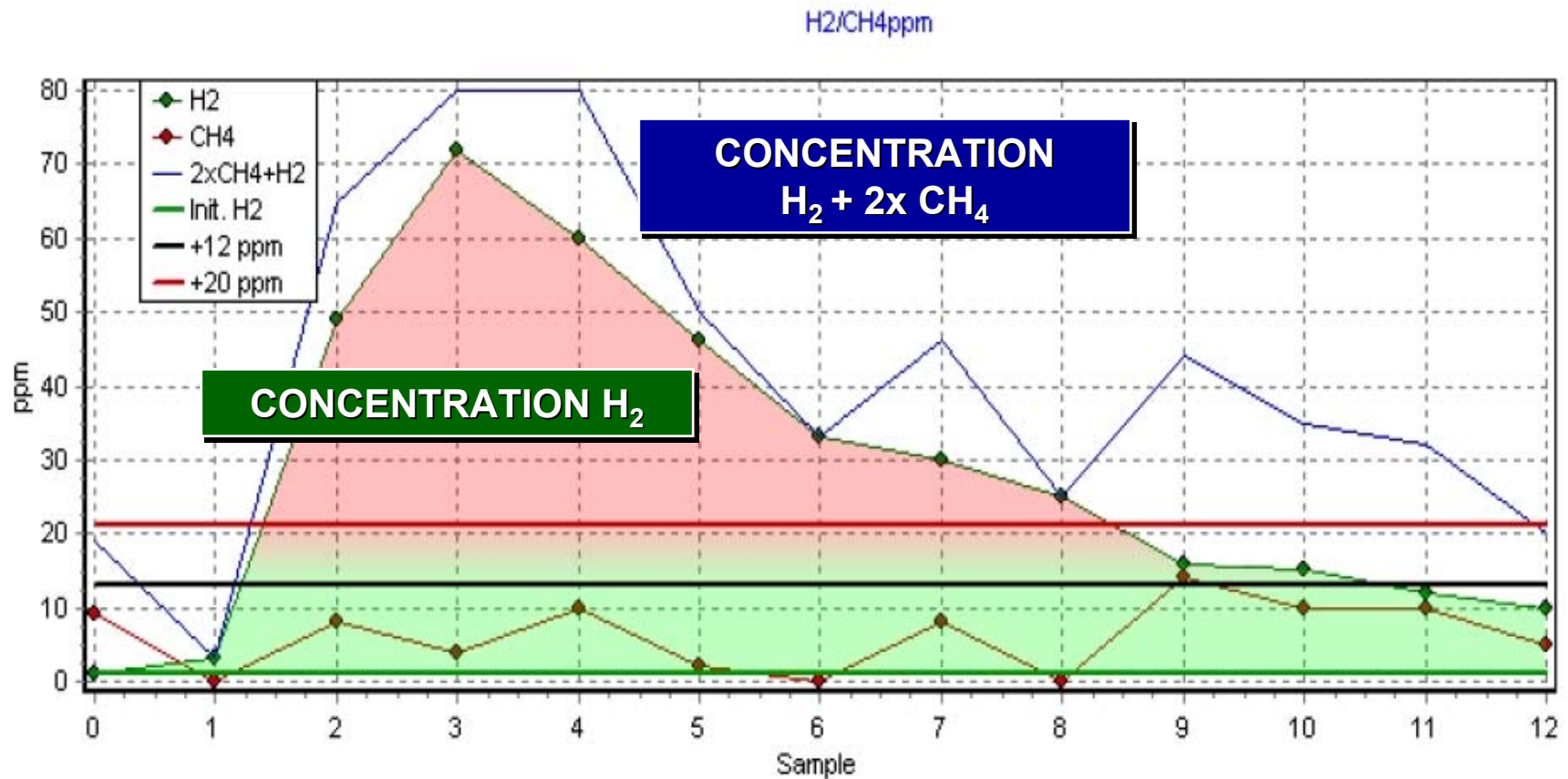
Breath test	Indication	Sensitivity	Specificity
Glucose HBT	SIBO	62%	83%
Lactulose HBT	SIBO	31%	86%
Fructose HBT	Malabsorption	98%	86%
Lactose HBT	Malabsorption	80%	100%

Update on diagnostic value of breath test in gastrointestinal and liver diseases.

Siddiqui I, Ahmed S, Abid S.

World J Gastrointest Pathophysiol. 2016 Aug 15;7(3):256-265

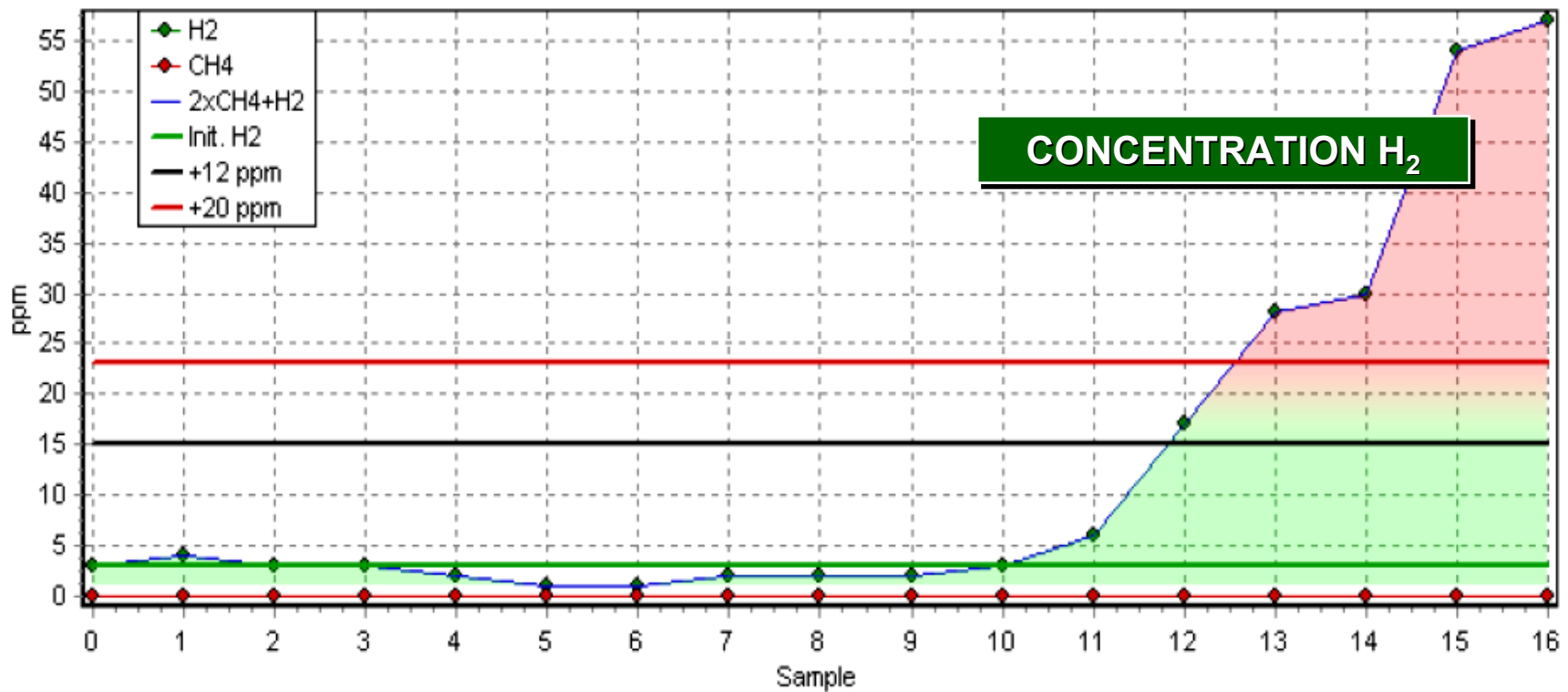
$H_2/CH_4/CO_2$ - GLUCOSE TEST FOR SIBO



75 g GLUCOSE

$H_2/CH_4/CO_2$ - LACTOSE MALABSORPTION

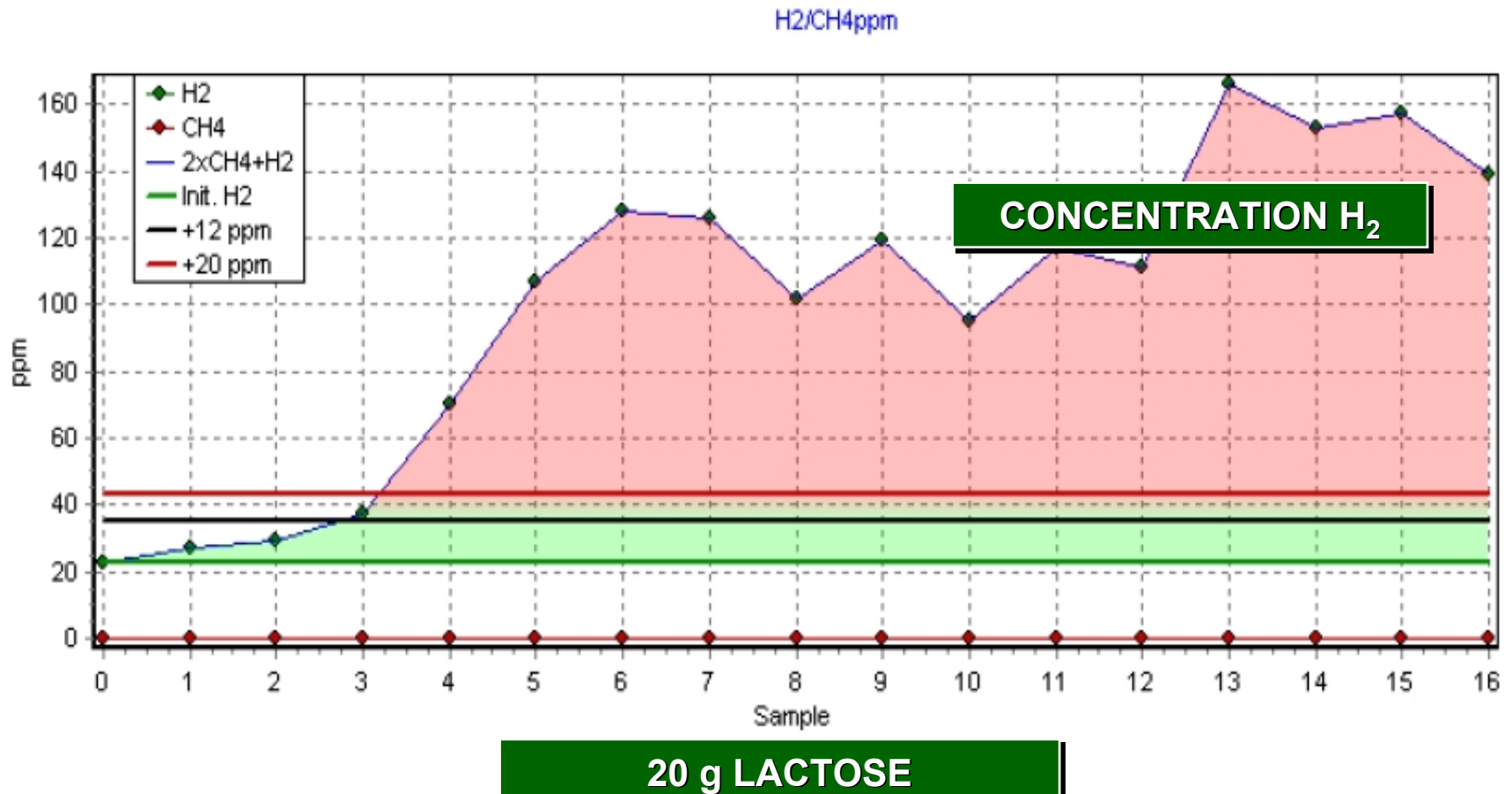
H_2/CH_4 ppm



CONCENTRATION H_2

20 g LACTOSE

$H_2/CH_4/CO_2$ - LACTOSE MALABSORPTION + SIBO

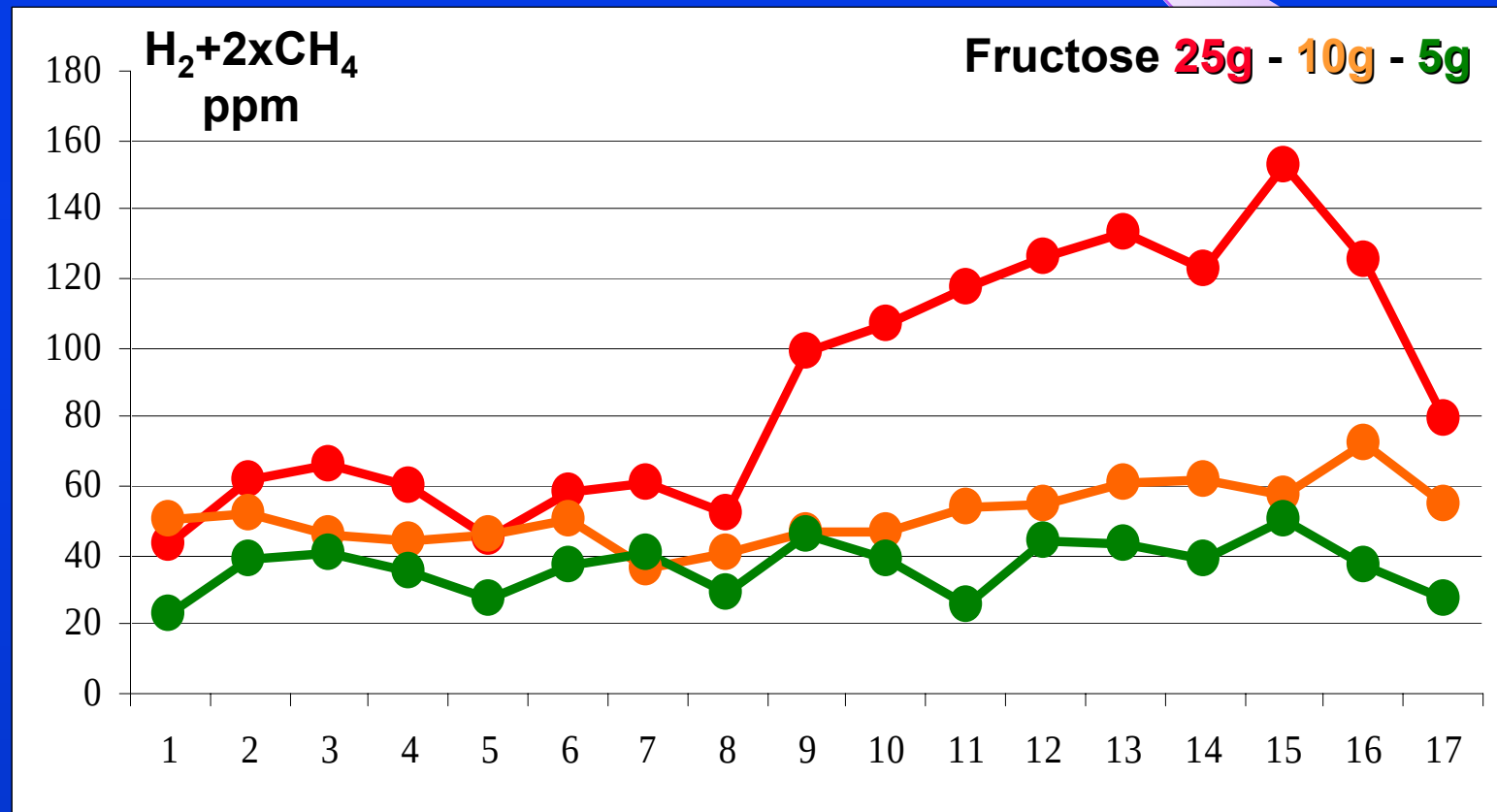




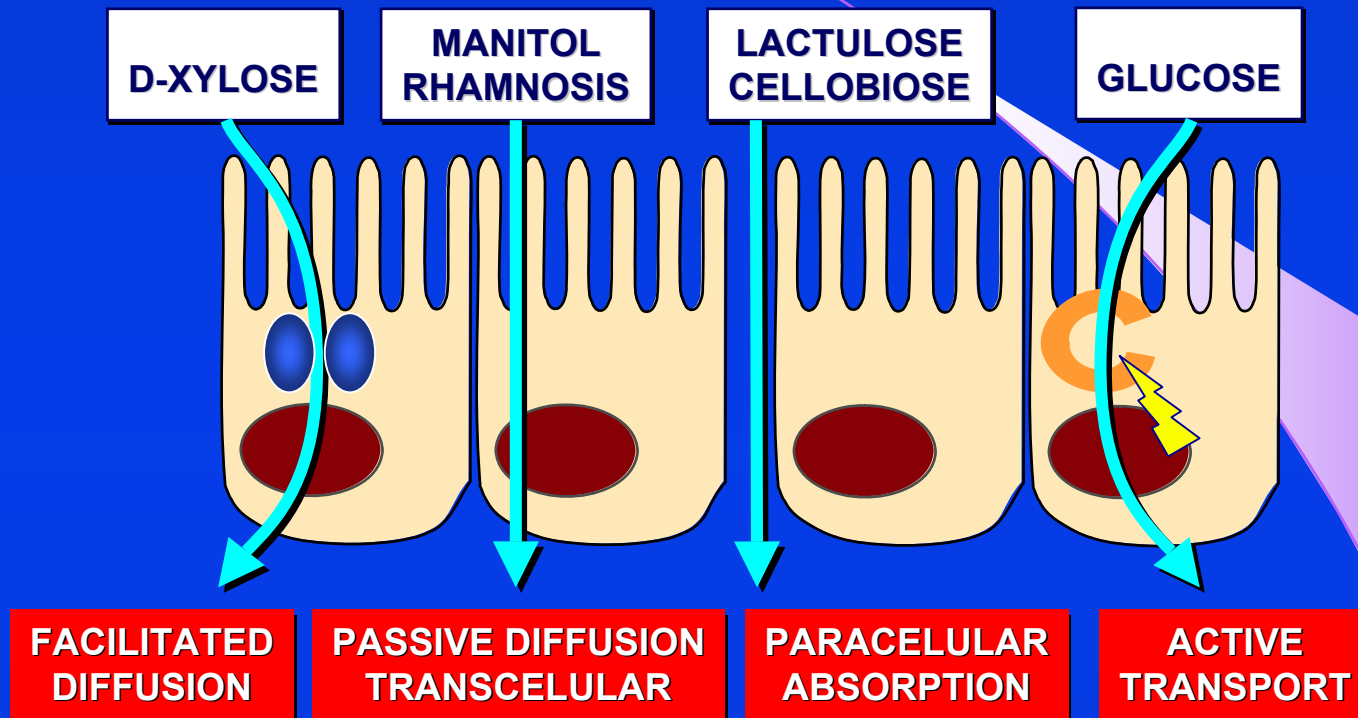
H₂-FRUCTOSE BREATH TEST

Fructose breath test - 46-year-old patient L.S.

Breath test performed with fructose in doses of 25g, 10g and 5g during 6 weeks
Samples taken every 4 hours and 15 minutes



INTESTINAL PERMEABILITY, ABSORPTION



- ORAL ADMINISTRATION - LACTULOSE 10g MANNITOL 2g XYLOSE 2g
- 5 HOUR COLLECTION OF URINE, DETERMINATION OF CONCENTRATIONS
- INDEX CALCULATION LA/MA, LA/XY

Assessment of intestinal permeability: enzymatic determination of urinary mannitol, raffinose, sucrose and lactose on Hitachi analyzer.
Hessels J. et al. - Clin Chem Lab Med. 2003;41:33-38



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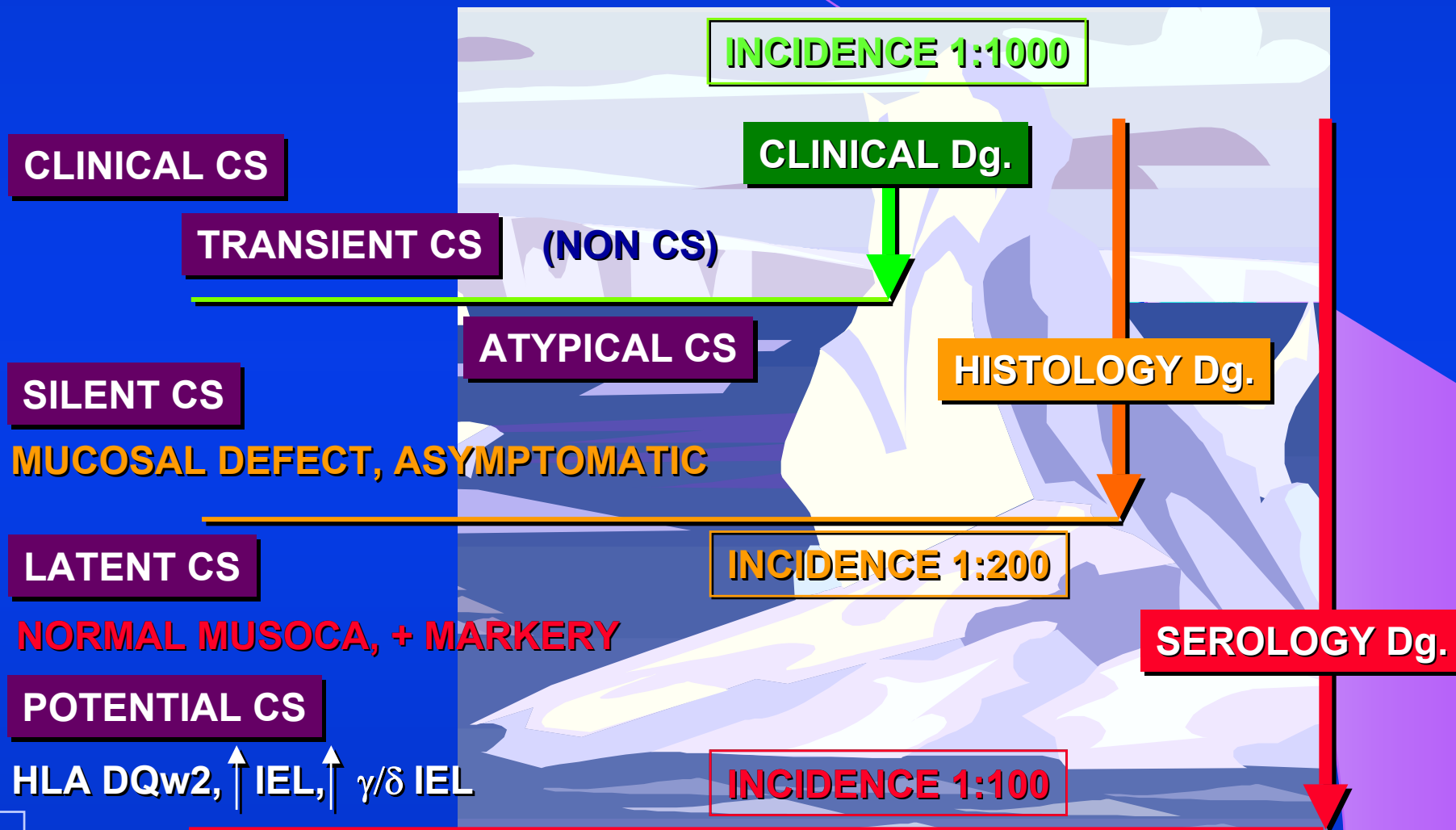


WHAT IS CELIAC DISEASE?

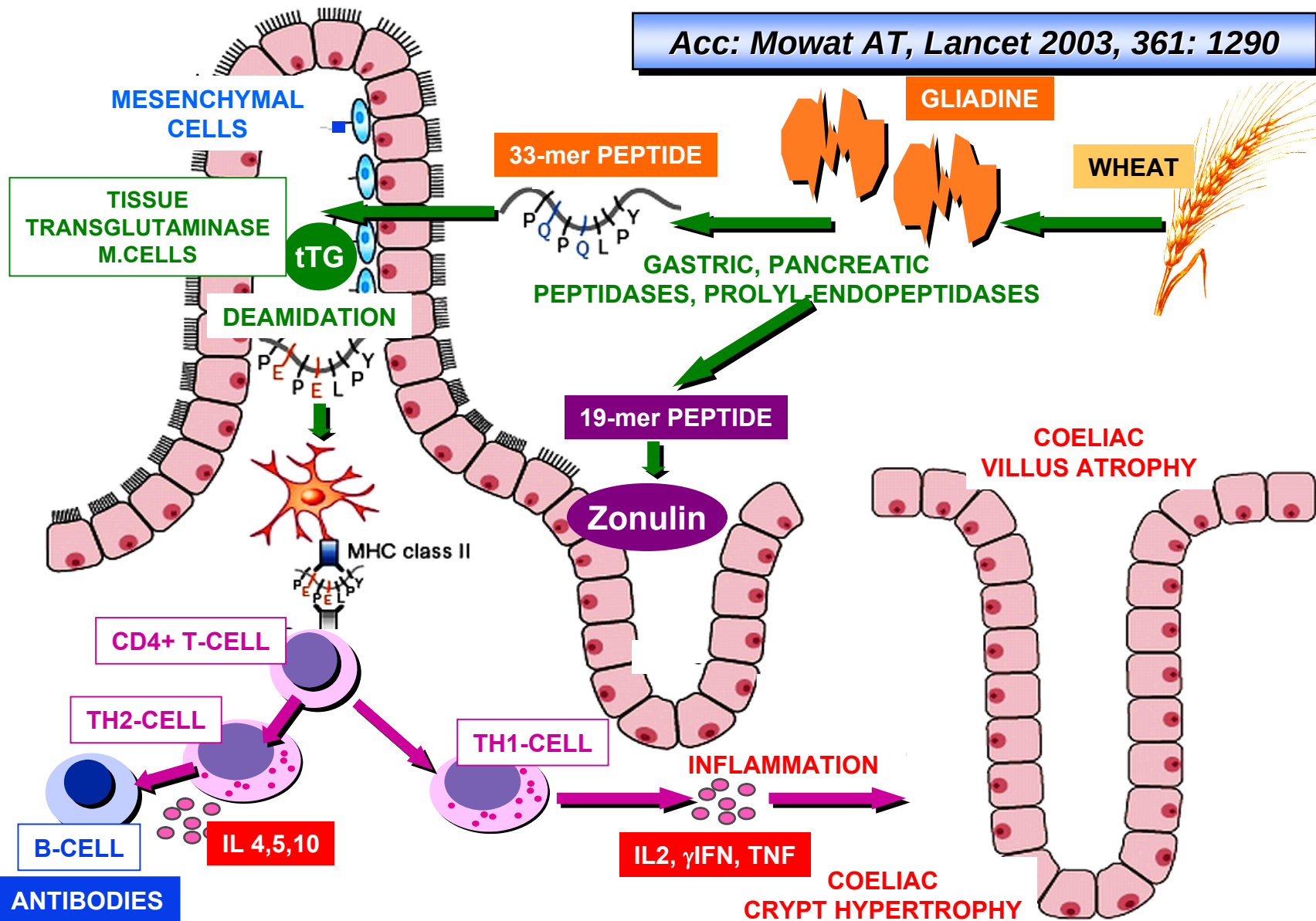


- **LIFELONG DISEASE, PERMANENT GLUTEN INTOLERANCE**
- **GENETIC FACTOR IS HLA-B8, HLA-DR3 and HLADQ2**
- **GLIADIN PEPTIDES ARE THE TRIGGERING FACTOR**
- **IMMUNOLOGICAL RESPONSE, AUTOIMMUNE CHARACTER**
- **DAMAGE TO THE MUCOSA OF THE SMALL INTESTINE**
- **MANIFESTATIONS OF MALABSORPTION SYNDROME**
- **THE ANSWER TO A GLUTEN-FREE DIET**

ICEBERG HYPOTHESIS OF COELIAC INCIDENCE



Acc: Mowat AT, Lancet 2003, 361: 1290



COELIAC DIAGNOSIS - HISTOLOGY

mucous villi

enterocytes

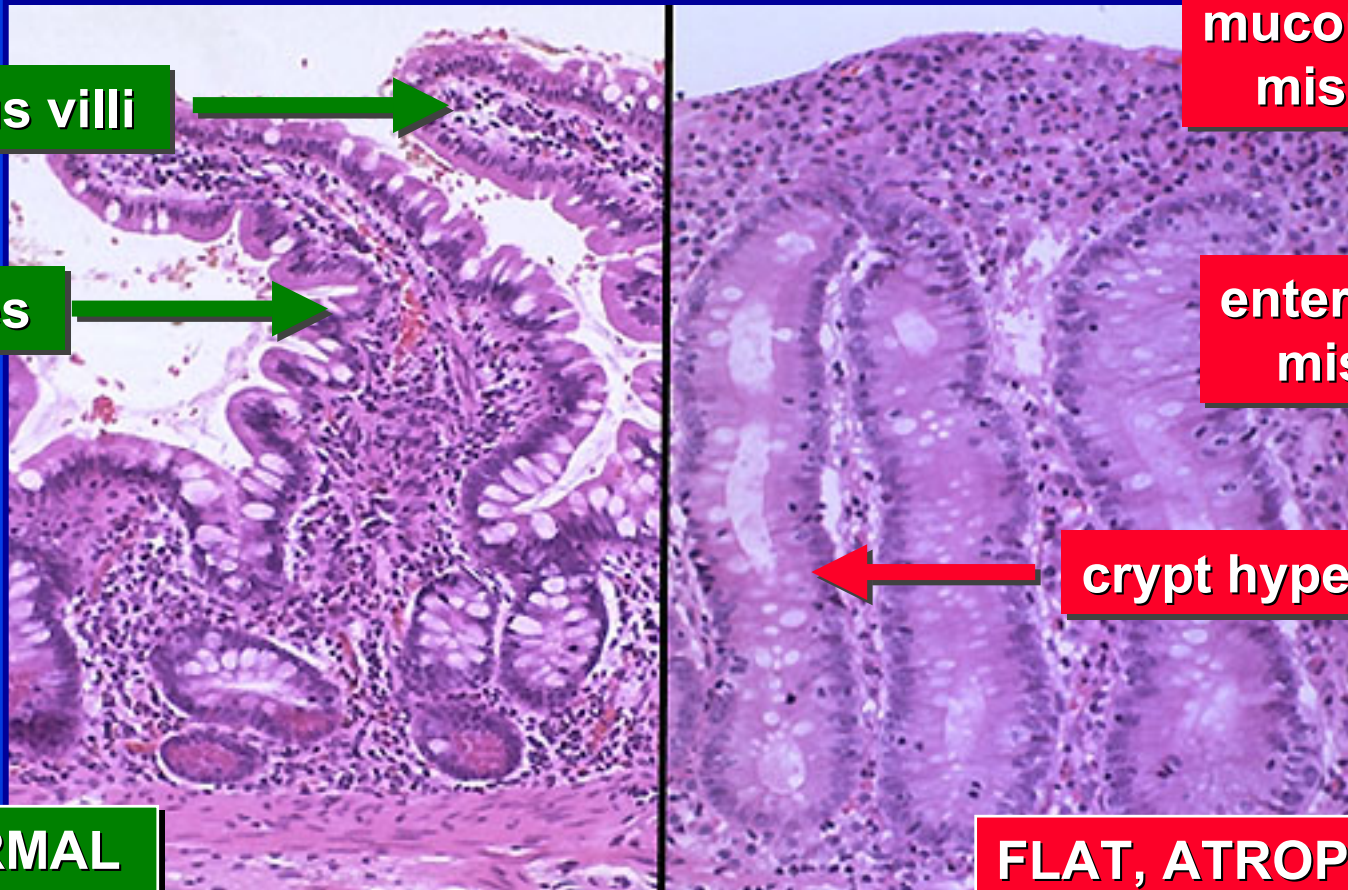
**NORMAL
MUCOSA**

mucous villi
missing

enterocytes
missing

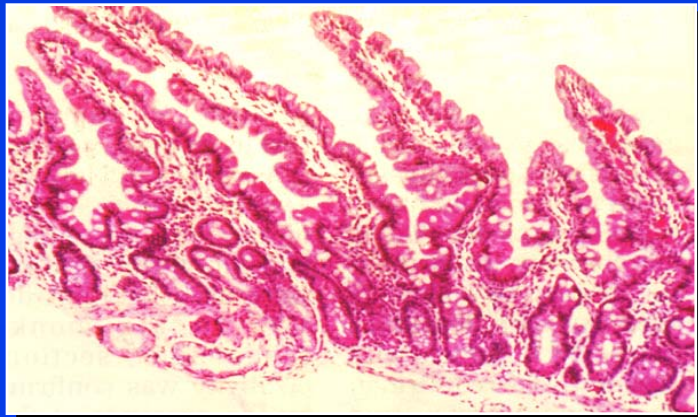
crypt hyperplasia

**FLAT, ATROPHIC
MUCOSA**



GLUTEN FREE DIET (GFD) - SCREENING & DIAGNOSTICS

NORMAL MUCOSA



NEGATIVE ANTIBODIES

**HEALTHY SUBJECT
TREATED COELIAC**

**TREATED COELIAC ?
OTHER AUTOIMMUNITY ?**

**FLORID COELIAC
UNTREATED**

POSITIVE ANTIBODIES

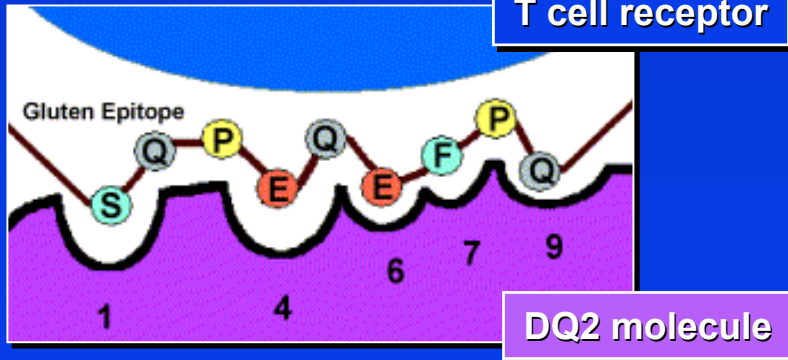
TOTAL ATROPHY





T cell receptor

GLUTEN FREE DIET - CEREALS



DECREASING PATHOGENICITY FOR CS

WHEAT RYE BARLEY OATS RICE SORGHUM MILLET MAIZE
GLIADIN SECALIN HORDEIN AVENIN ZEIN



mAb
Gliadin
standard

DECREASING TEST SENSITIVITY





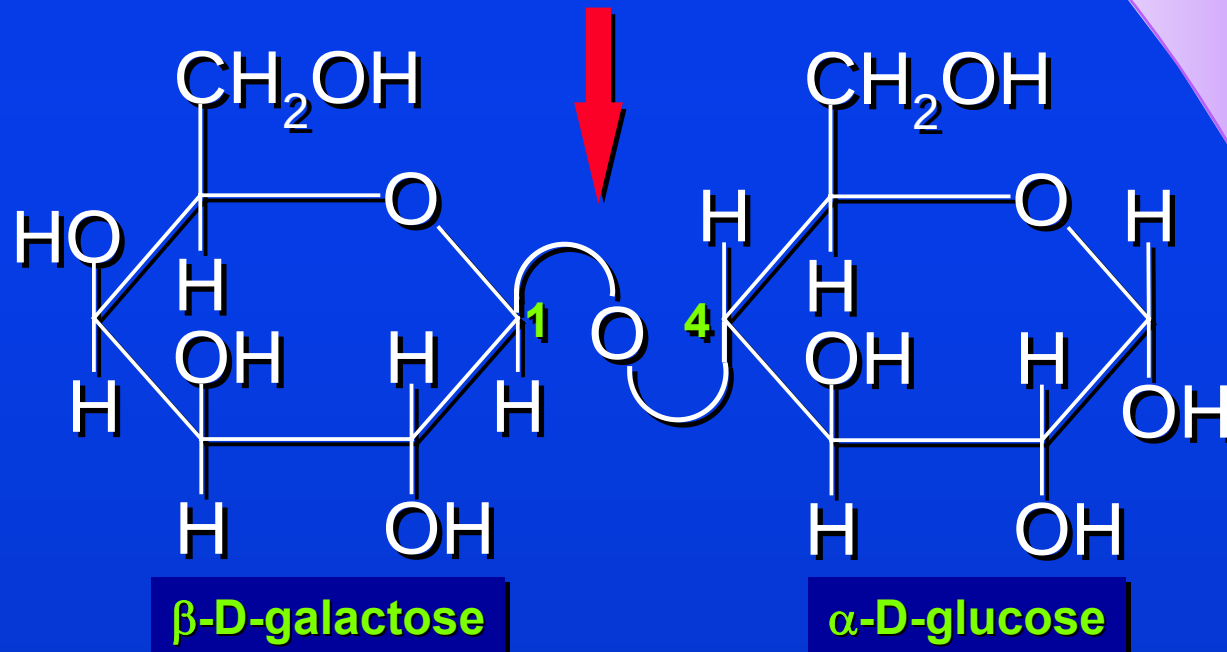
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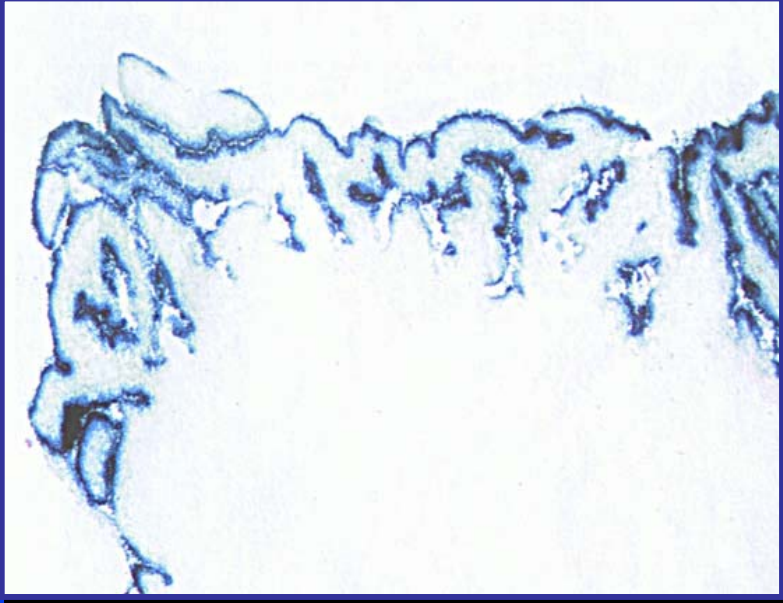
LACTASE INTOLERANCE

**DISACCHARIDE - LACTOSE IS HYDROLYZED
INTESTINAL DISACCHARIDASE**

LACTASE



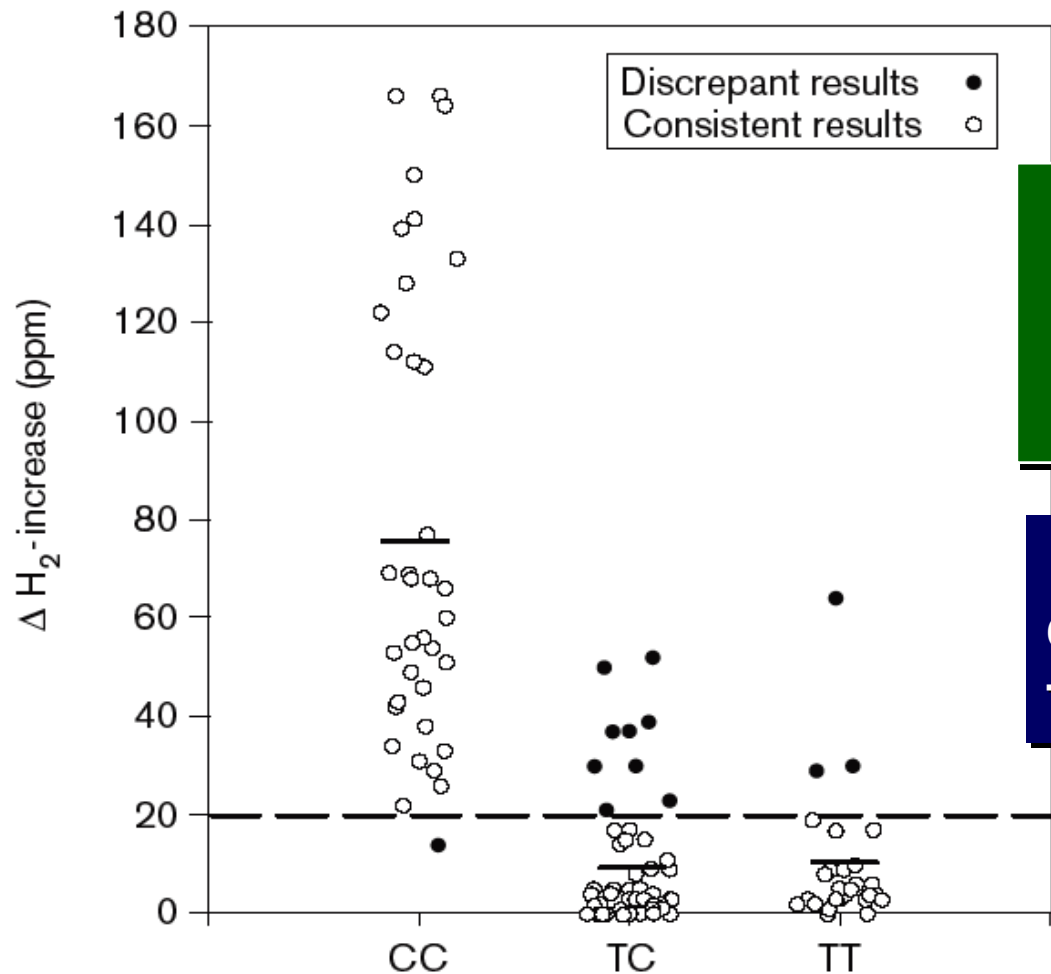
DIAGNOSIS OF LACTASE INTOLERANCE



**HISTOCHEMICAL EVIDENCE
ACTIVITIES OF LACTASE IN THE
BRUSH BORDER OF THE ENTEROCYTE
IMMUNOHISTOCHEMICAL DETECTION**

**MODERN RAPID TEST
DETECTION OF LACTASE ACTIVITY
CHROMOGENIC METHOD**





**PCR DETECTION
13910 T/C POLYMORPHISM
CORRELATION
WITH H₂-BREATH TEST**

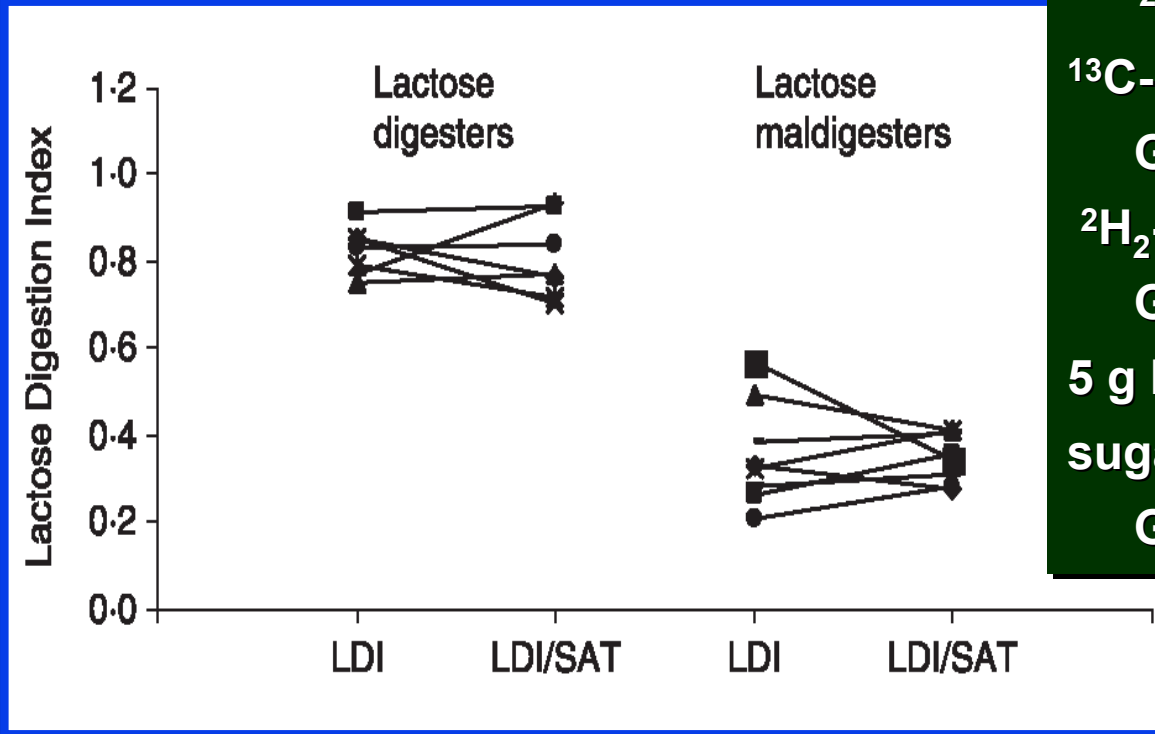
**GENOTYPES 13910
CC - LACTOSE INTOLERANCE
TC, TT - LACTOSE TOLERANCE**

Hogenauer C, Hammer H.F., Mellitzer K. et al.: Evaluation of a new DNA test compared with the lactose hydrogen breath test for the diagnosis of lactase non-persistence. Eur.J.Gastro.Hepato. 2005, 17:371–376





COMBINED LDI - SAT INDEX



LDI: 25 g ^{13}C -lactose + 0.5 g 6,6- $^2\text{H}_2$ -glucose

^{13}C -glucose enrichment
GC/C/IRMS;

$^2\text{H}_2$ -glucose enrichment
GC/MSSAT:

5 g lactulose, 1 g L-rhamnose;
sugar level in urine

GC

Combined LDI/SAT test to evaluate intestinal lactose digestion and mucosa permeability. Koetse HA, Klaassen D, ... Stellaard F.

Eur J Clin Invest. 2006; 36(10): 730 - 736



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PANCREATIC INSUFFICIENCY
SMALL INTESTINAL BACTERIAL OVERGROWTH





EXOCRINE PANCREATIC INSUFFICIENCY - PEI

Causes of exocrine pancreatic insufficiency - EPI

Chronic pancreatitis - the main cause of EPI

Cystic fibrosis

Pancreatic duct obstruction (tumor, lithiasis)

Celiac disease, Crohn's disease, Schwachman-Diamond syndrome

Postoperative status (gastrectomy, gastric bypass, TS operation)

Inactivation of pancreatic enzymes (low pH), Zollinger-Ellison syndrome

Diabetes mellitus



CHRONIC PANCREATITIS DIAGNOSTICS

Diagnostic imaging for mild chronic pancreatitis

Endoscopic ultrasound (EUS)

Endoscopic retrograde cholangiopancreatography (ERCP)

Magnetic resonance cholangiopancreatography (MRCP)

	EUS	ERCP	MRCP
SENSITIVITY	56% (40-72)	72% (58-86)	54% (44-64)
SPECIFICITY	81% (68-95)	75% (60-90)	78% (72-83)

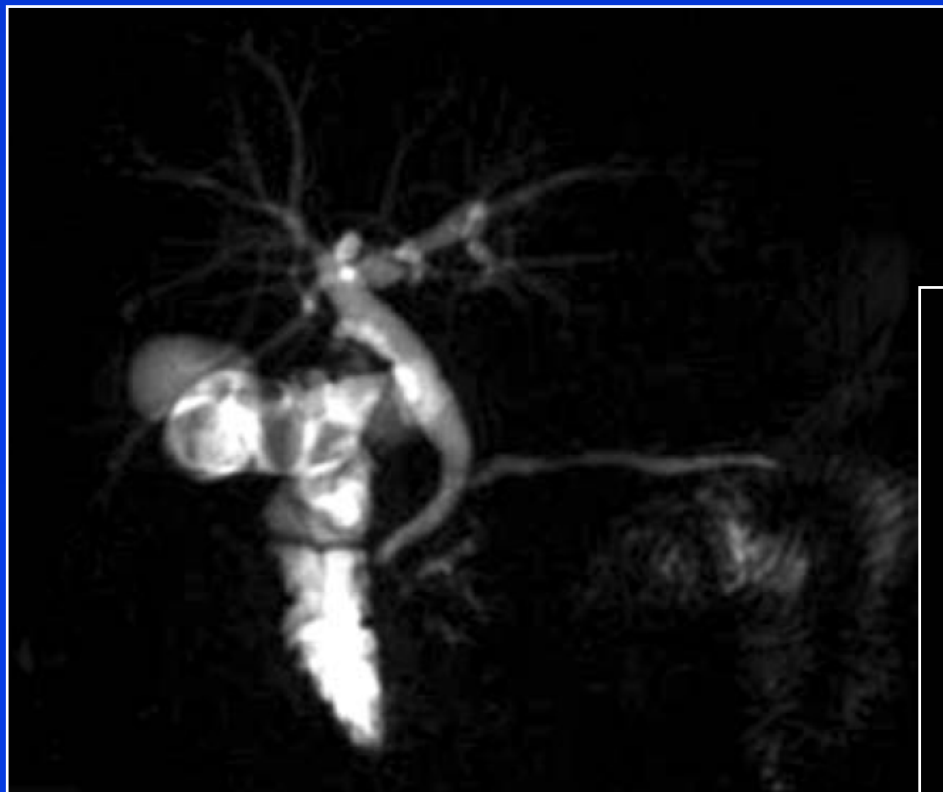
Diagnosis of mild chronic pancreatitis (Cambridge classification)

Sai JK, Suyama M, Kubokawa Y, Watanabe S.

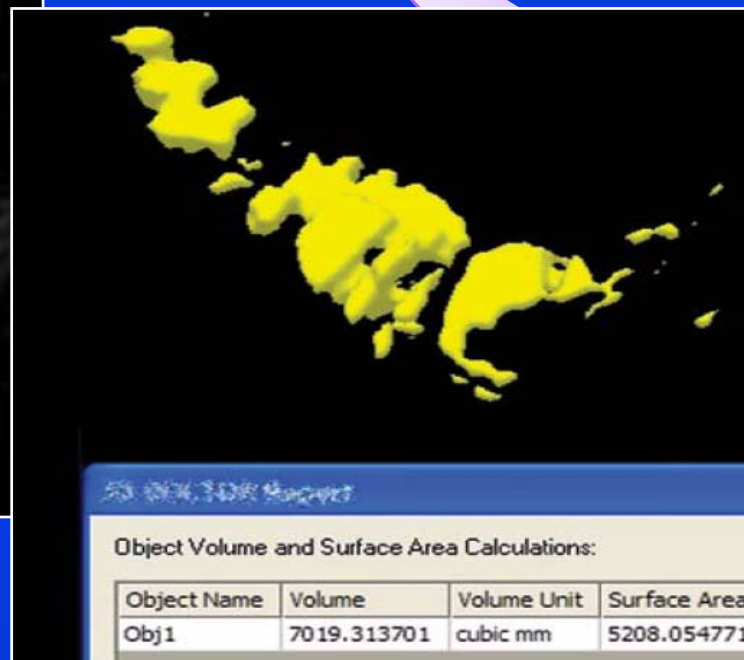
World J Gastroenterol 2008 February 28; 14(8): 1218 - 1221

Researchers Test the Value of ERCP for the Detection of Early Chronic Pancreatitis

Frei R. - Gastroent.Endoscop.News 2007, 58, 02



MRCP - SECRETION VOLUME MATHEMATICAL PROCEDURE PANCREATIC FUNCTION TEST



Manfredi, R., Perandini, S., Mantovani, W. et al. Quantitative MRCP assessment of pancreatic exocrine reserve and its correlation with faecal elastase-1 in patients with chronic pancreatitis. Radiol med 117, 282–292 (2012).



EXOCRINE PANCREAS INSUFFICIENCY GUIDELINES

Which test is clinically indicated

for diagnosing exocrine pancreatic insufficiency (PEI) ?

Statement 3-6. In a clinical setting, a **non-invasive pancreatic function test (PFT) should be performed.** The **FE-1 test** is feasible and widely available and is therefore most frequently used in this setting, while the **13C mixed triglyceride** breath test (13C-MTG-BT) offers an alternative. The s-MRCP test may also be used as an indicator of PEI but provides only semiquantitative data.
(Grade 1B, agreement)

Is a pancreatic function test required for the diagnosis of CP?

Statement 3-7. A function test is required for the diagnosis of CP.
(Grade 2B, strong agreement)

Should a pancreatic function test be performed at the time of diagnosis?

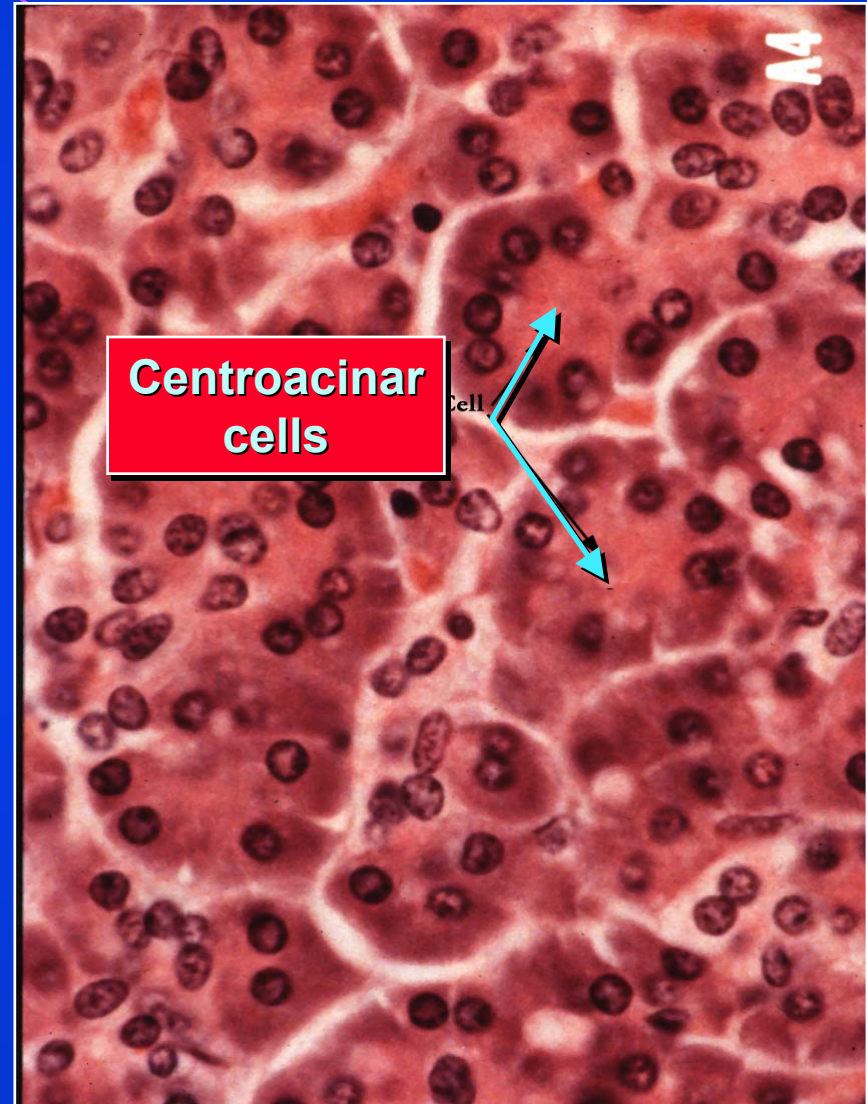
Statement 3-8. Every patient with a new diagnosis of CP
should be screened for PEI. (Grade 1A, strong agreement)

*Löhr M. - HaPanEU/UEG Working Group, UEG Journal, 2017, Vol. 5(2) 153–199
United European Gastroenterology evidence based guidelines for the diagnosis
and therapy of chronic pancreatitis (HaPanEU)*

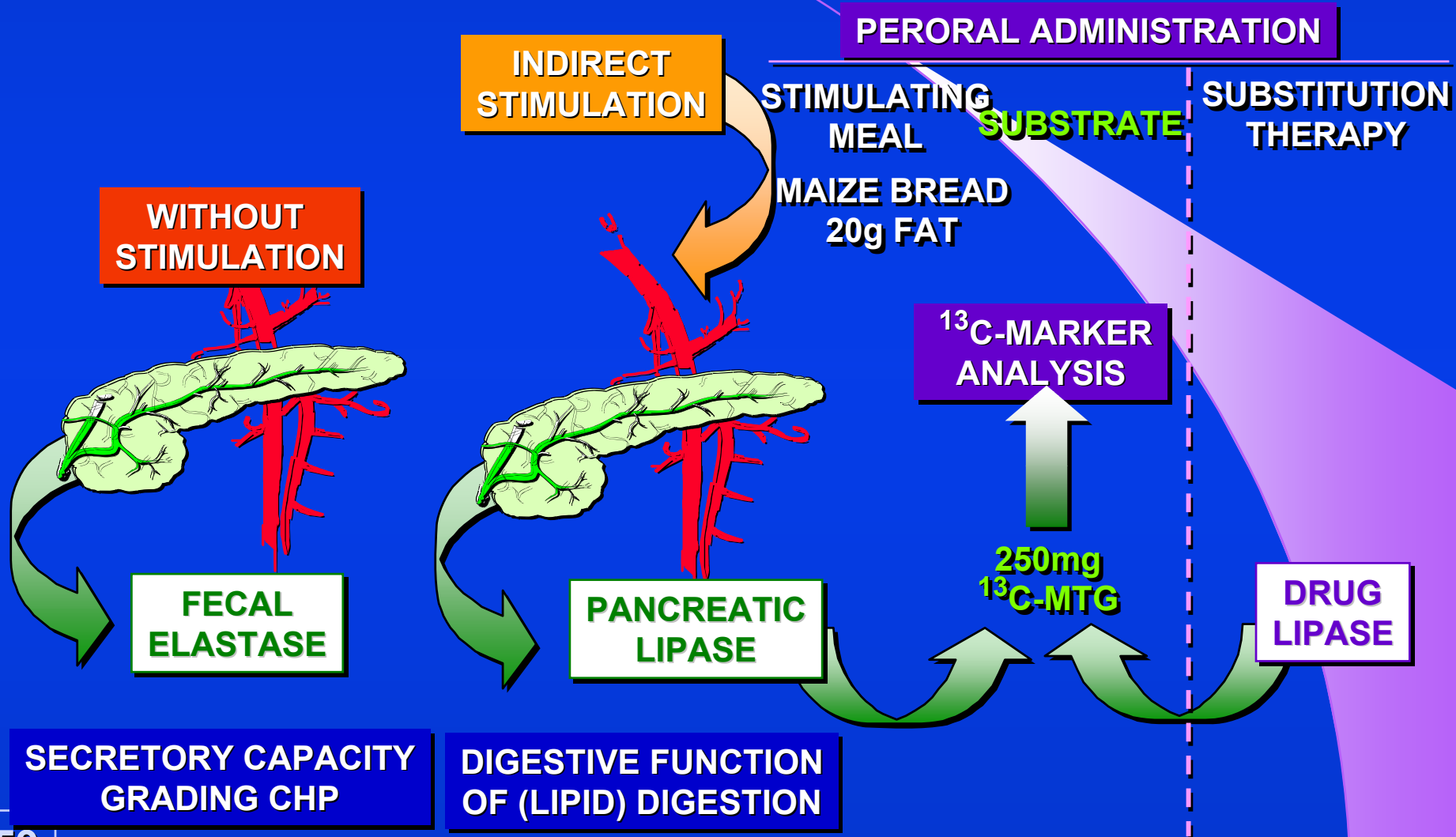
EXOCRINE PANCREAS SECRETORY ACINS

PANCREATIC ENZYMES pH OPTIMUM

α - AMYLASE	6.5 - 7.2
LIPASE	7 - 9
PHOSPHOLIPASE A₂	5.8 - 7.7
PHOSPHOLIPASE B	6
ELASTASE	8.6
TRYPSIN	7 - 9
CHYMOTRYPSIN	7.5 - 8.5
CARBOXYPEPTIDASE	7.5 - 7.8
CALICREINS	7 - 8



EXOCRINE PANCREATIC FUNCTION TESTS





AGA CLINICAL PRACTICE – UPDATE 2023

✓ BEST PRACTICE RECOMMENDATION 4:

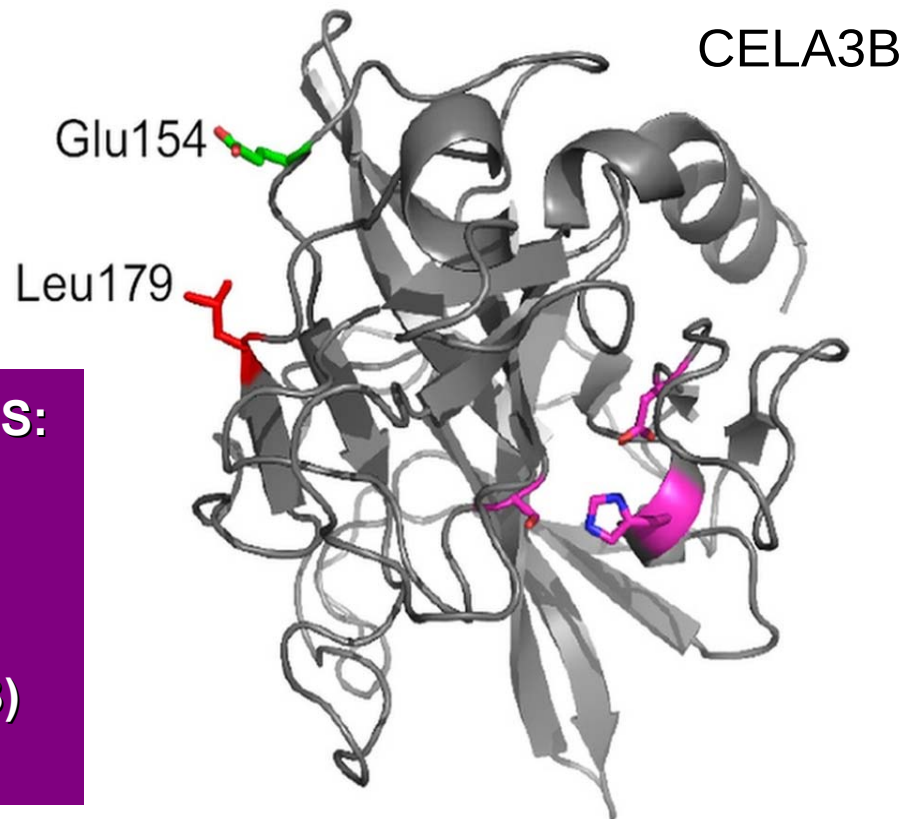
The stool elastase test is the **most appropriate initial test** and must be performed on a semi-solid or solid stool sample. A stool elastase level <100 mg/g stool provides good evidence of EPI and levels of 100–200 mg/g are indeterminate for EPI.

✓ BEST PRACTICE RECOMMENDATION 5:

Stool elastase testing can be performed **during pancreatic enzyme replacement therapy**

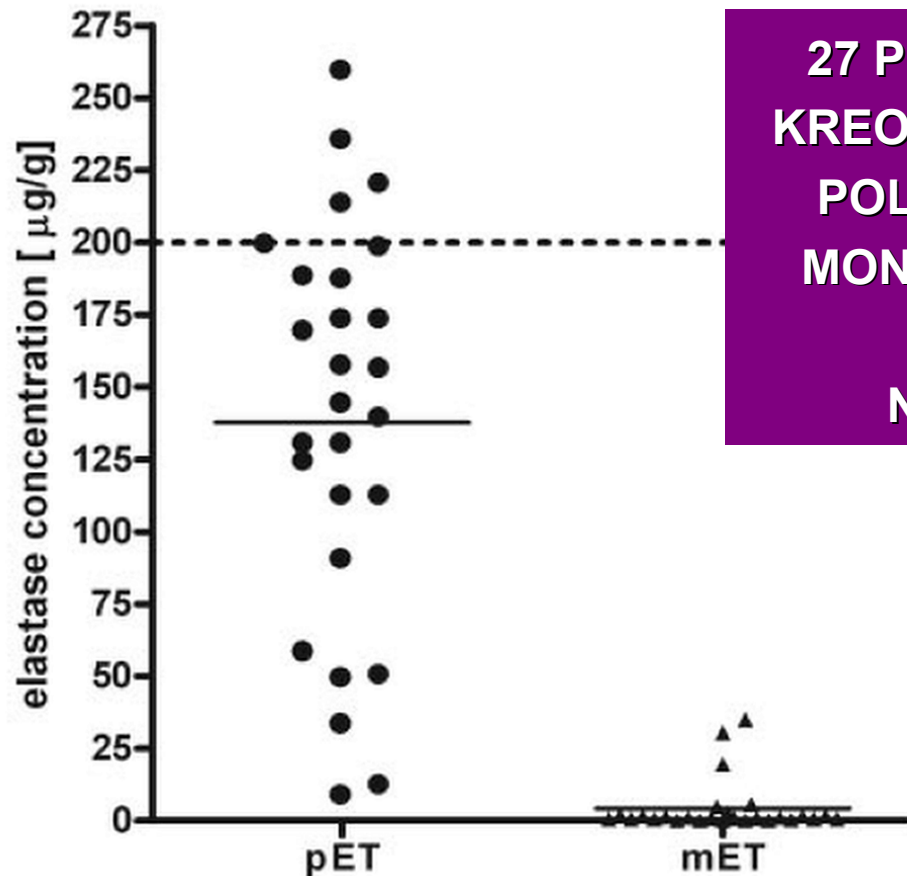
PANCREATIC ELASTASE IN THE STOOL

ELISA - TWO DIFFERENT METHODS:
MONOCLONAL ANTIBODY
AGAINST ELA1 (ENTIRE1)
POLYCLONAL ANTIBODY
AGAINST ELA3A,3B (ENTIRE3A,B)
NORMAL VALUES > 200 µg/g



Tóth AZ, Szabó A, Hegyi E, Hegyi P, Sahin-Tóth M. Detection of human elastase isoforms by the ScheBo Pancreatic Elastase 1 Test. Am J Physiol Gastrointest Liver Physiol. 2017; 312(6): G606-G614

PANCREATIC ELASTASE IN STOOL – FELA x PELA

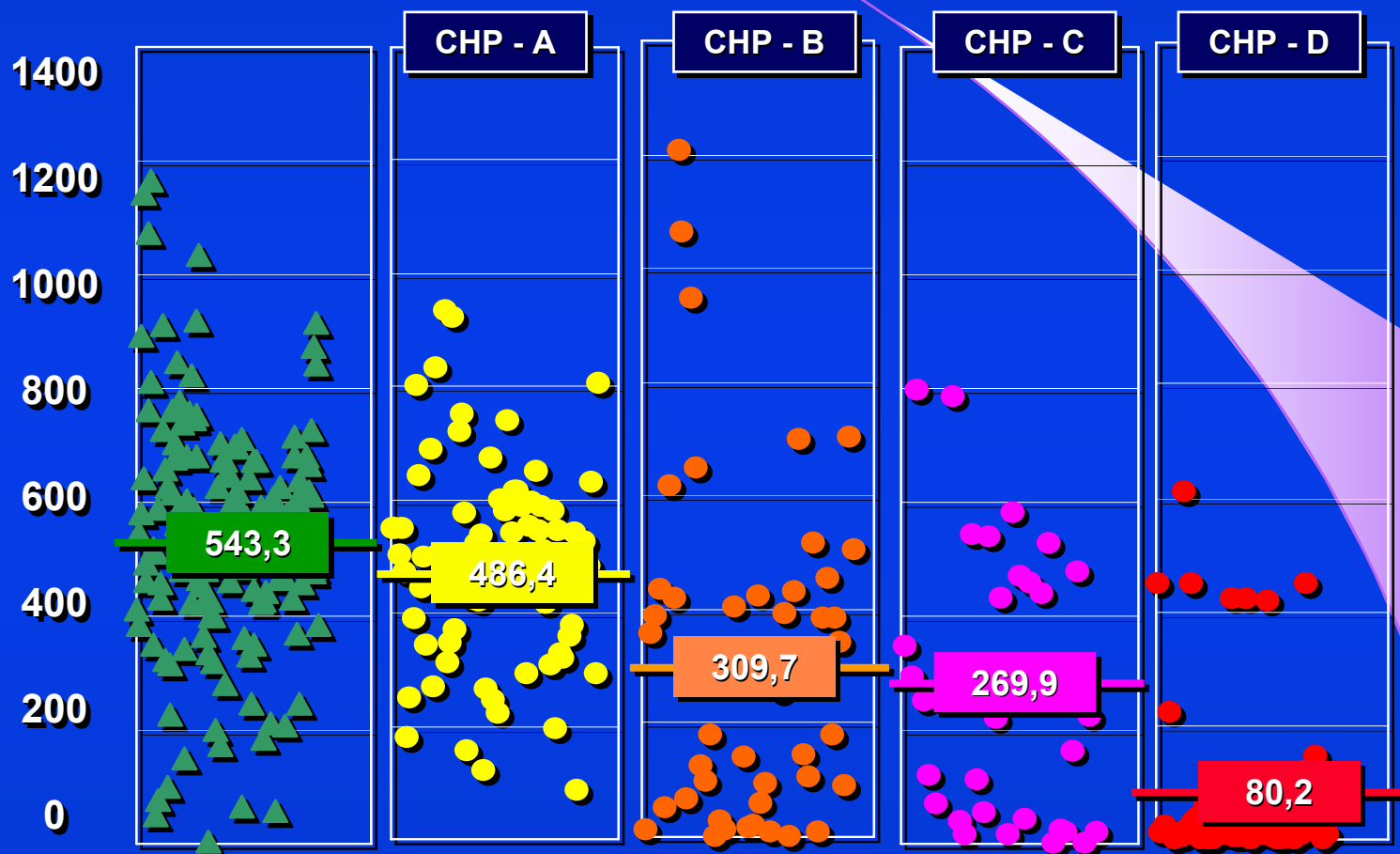


27 PEOPLE WITH CYSTIC FIBROSIS
KREON, LIPASE, 5,000-10,000 U/kg/day
POLYCLONAL - pET - 138 ± 69 µg/g
MONOCLONAL - mET - 4.3 ± 9.0 µg/g
SIGNIFICANCE $p < 0.0001$
NORMAL VALUES > 200 µg/g

Schneider A, Funk B, Caspary W, Stein J.: Monoclonal versus Polyclonal ELISA for Assessment of Fecal Elastase Concentration: Pitfalls of a New Assay. Clinical Chemistry 2005: 51/6, 1052-1054



DETERMINATION OF ELASTASE-I IN THE STOOL AT CHP



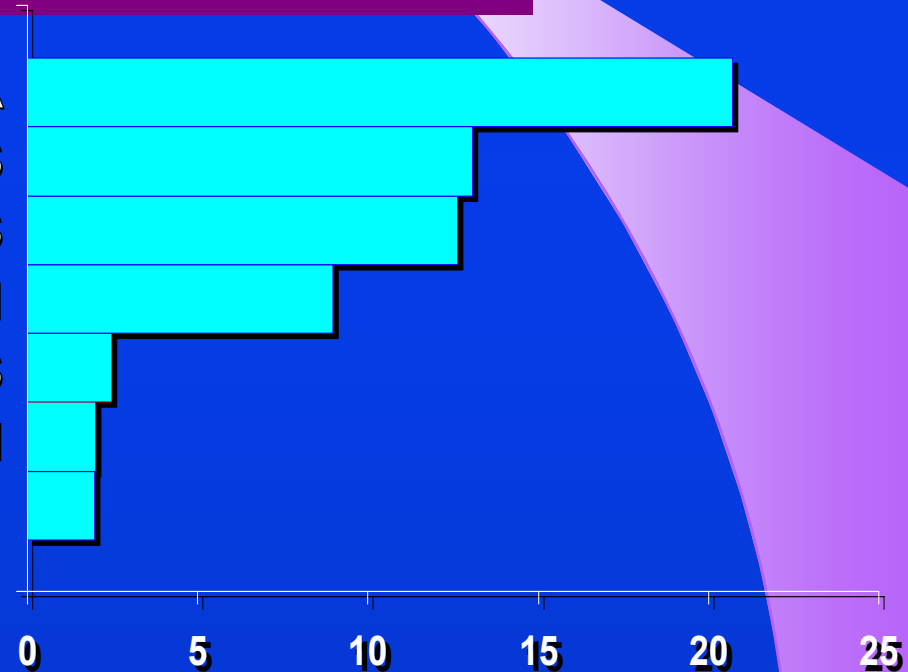
368 STOOL SAMPLES ScheboTech ELISA ELASTASE
1155 CONTROLS (NON-CHP), 213 CHP CLASSIFIED A-B-C-D



PANCREATIC ELASTASE 1 - ELISA - VFN PRAGUE

**9968 STOOL SAMPLES EXAMINED,
FROM CHILDREN 4068 - 40.8%
1381 FELA TEST VALUES < 100 - 13.5%
1897 FELA TEST VALUES < 200 - 18.8%**

**DYSPEPSIA
CYSTIC FIBROSIS
PANCREATITIS
ABDOMINAL PAIN
DIABETES
MALABSORPTION
BOWEL DISEASE**



*Kocna P.: Laboratorní diagnostika exokrinní funkce pankreatu.
Klin. Biochem. Metab. 2020, 28 (49)/4; 150-160*



^{13}C - BREATH TESTS FOR PANCREATIC FUNCTION

SUBSTRATE SELECTION

- ^{13}C - TRIOLEIN
- ^{13}C - HIOLEIN
- ^{13}C - MIXED
TRIGLYCERIDE
- ^{13}C - CHOLESTERYL
OCTANOATE
- ^{13}C - TRIPALMITIN
- ^{13}C - TRIOCTANOIN
- ^{13}C - STARCH
- ^{13}C - BzTyrAla

STEATORRHEA > 11 - 14 g/day

INTRALUMINAL LIPOLYSIS

SPECIFICITY FOR PANCREATIC LIPASE

LIPASE OUTPUT < 90 kU/hr

PANCREAT. CHOLESTEROL ESTERASE

STEATORRHEA > 11 g/day

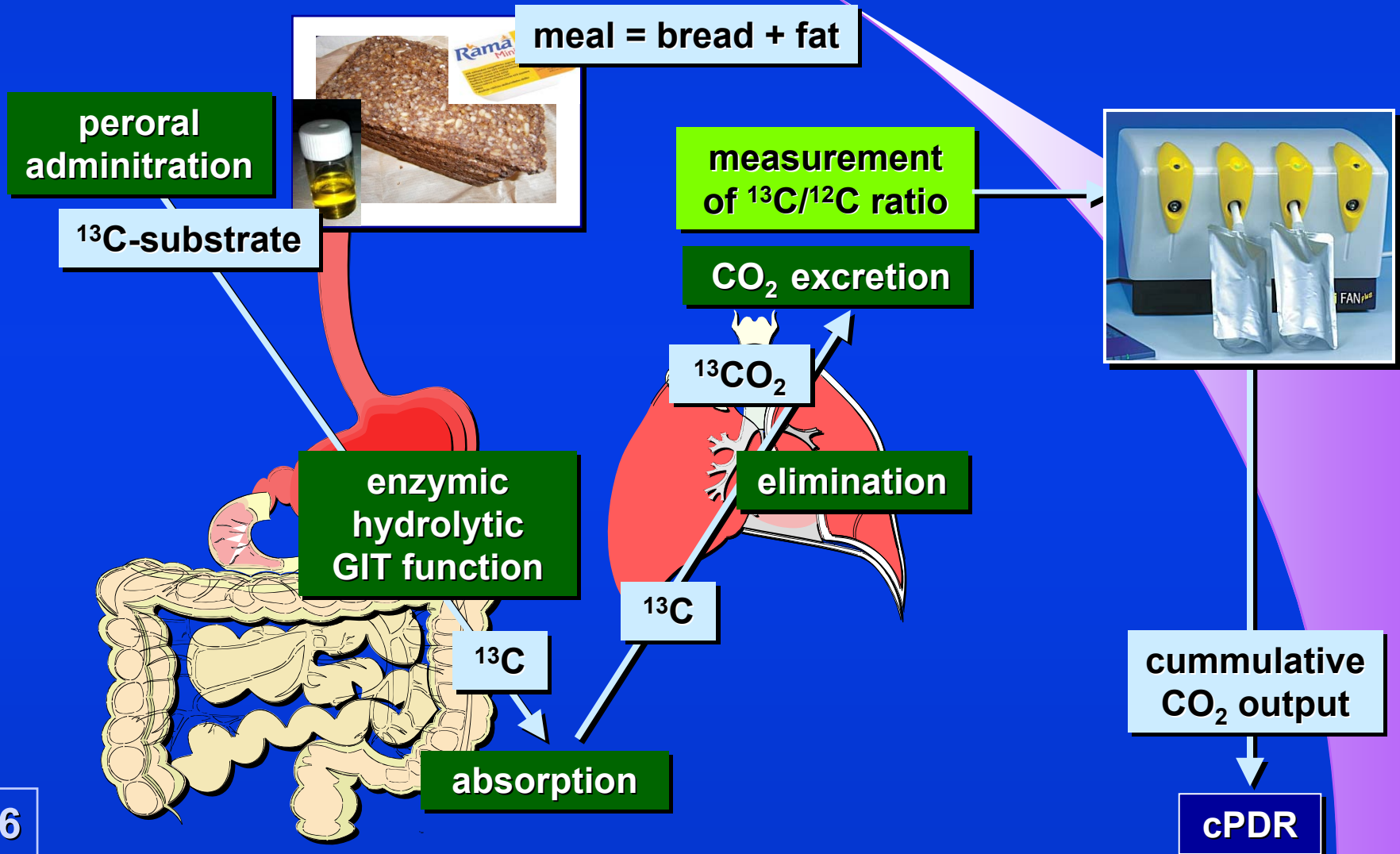
FAT MALABSORPTION

TISSUE DAMAGE, FIBROSIS > 30%

AMYLASE SECRETION < 10%

CORRELATION with the PABA test

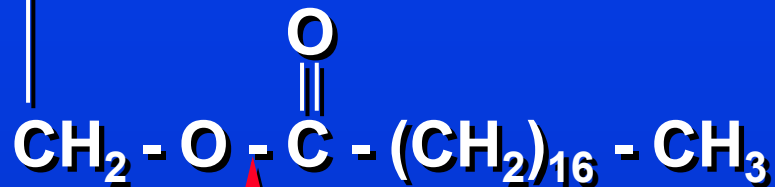
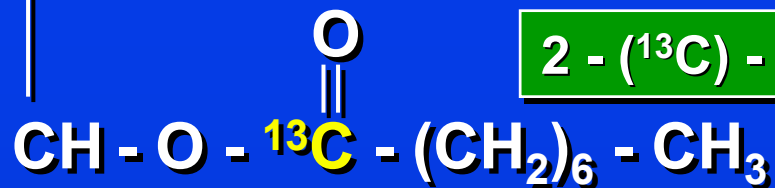
^{13}C - MIXED TRIGLYCERIDE - ^{13}C -MTG BREATH TEST



^{13}C - MIXED TRIGLYCERIDE - ^{13}C -MTG BREATH TEST

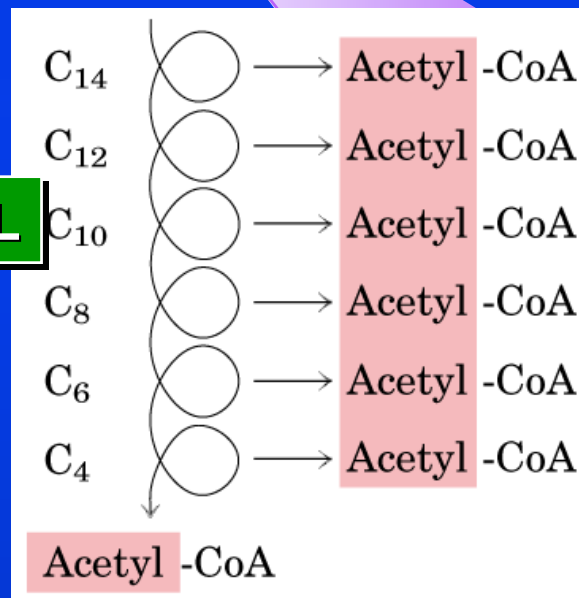
PANCREATIC LIPASE

1,3 DI - STEAROYL



2 - (^{13}C) - OCTANOYL

BREATH $^{13}\text{CO}_2$

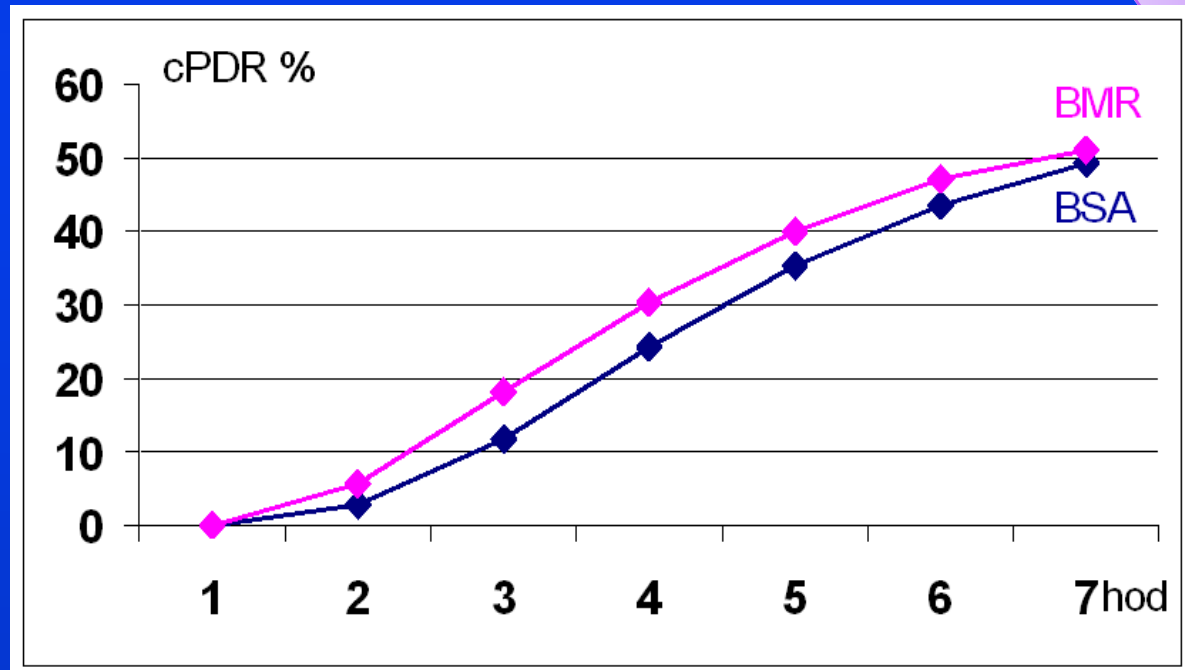


HEPATAL β - OXIDATION



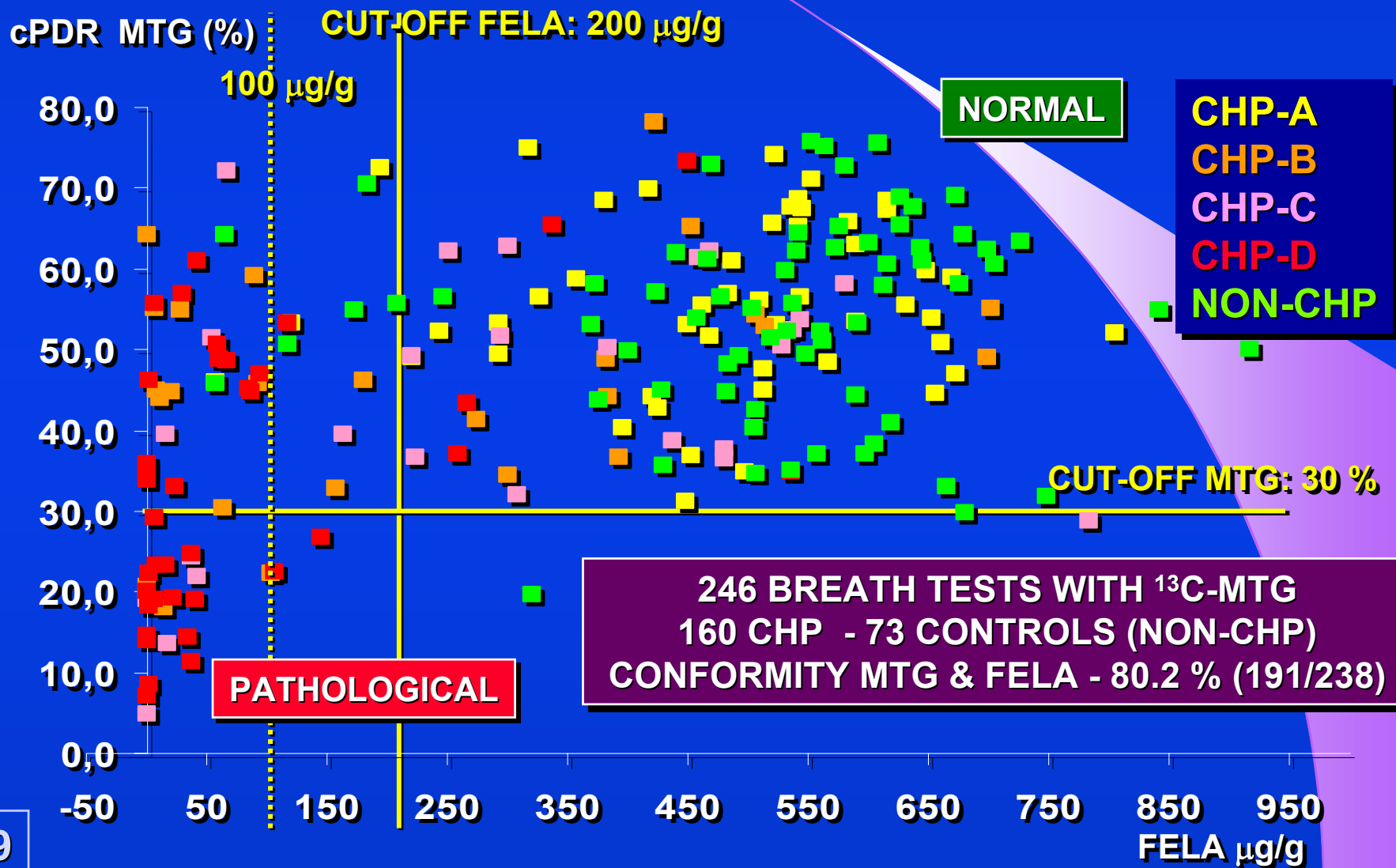
^{13}C - MIXED TRIGLYCERIDE - ^{13}C -MTG BREATH TEST

^{13}C -MTG test - in our arrangement we serve
100 g of gluten-free bread with
250 mg of mixed triglyceride in 20 g of margarine
breath samples at time T_0 to T_{360} minutes after 60 minutes
 $\text{cPDR}_{6\text{h}}$ pathological below 30% (BMR)



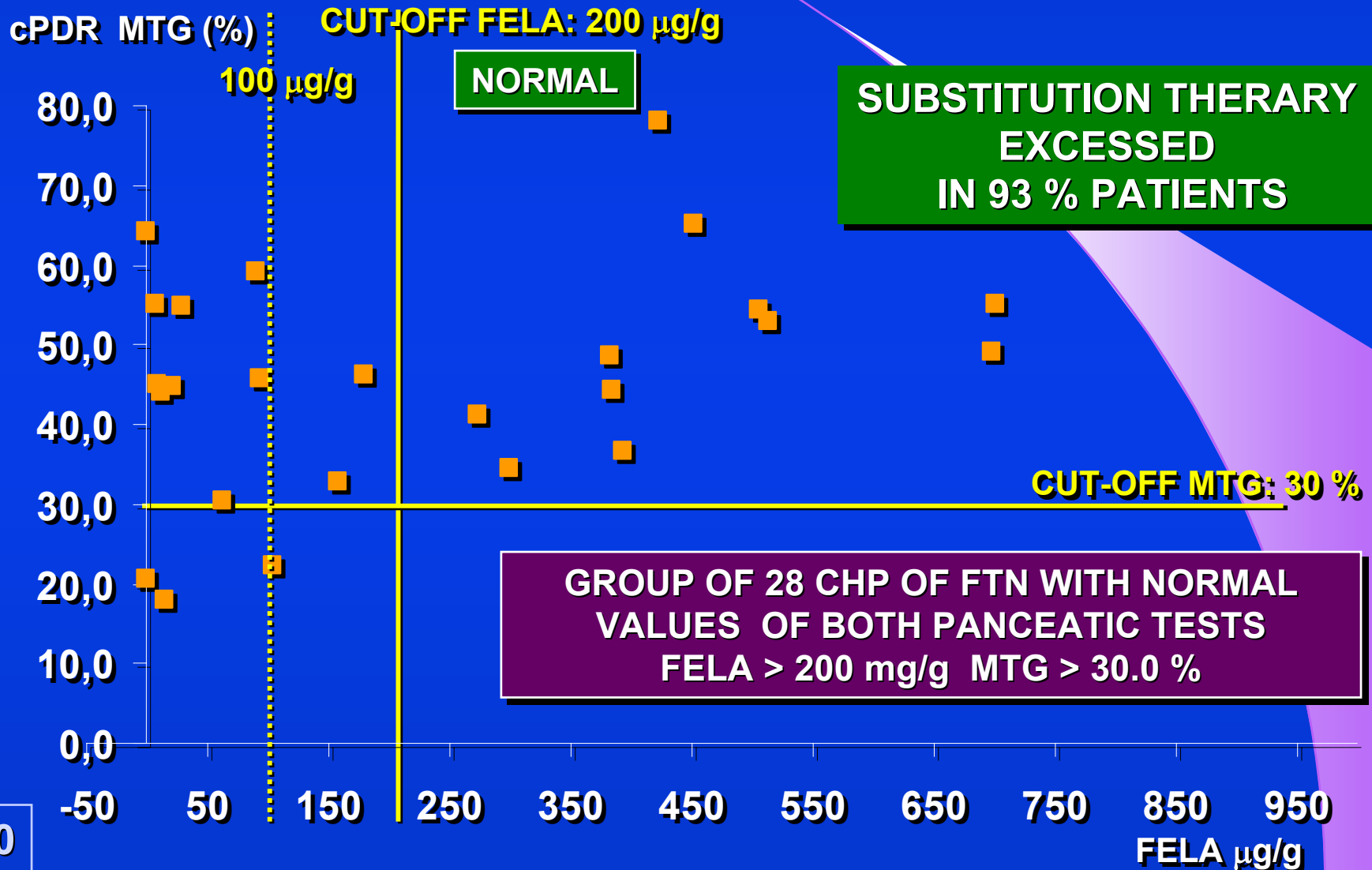


^{13}C -MTG - BREATH TEST & FELA IN STOOL





^{13}C -MTG - BREATH TEST & FELA IN STOOL





PANCREAS RESECTION

SUBSTITUTION THERAPY

40 - 120 KIU LIPASE

THERAPY OK

FAILED THERAPY

COMBINATION WITH PPI

THERAPY OK

PABA, PLT, ¹³C-MTG TEST
WITH SUBSTITUTION

THERAPY OK

FAILED THERAPY

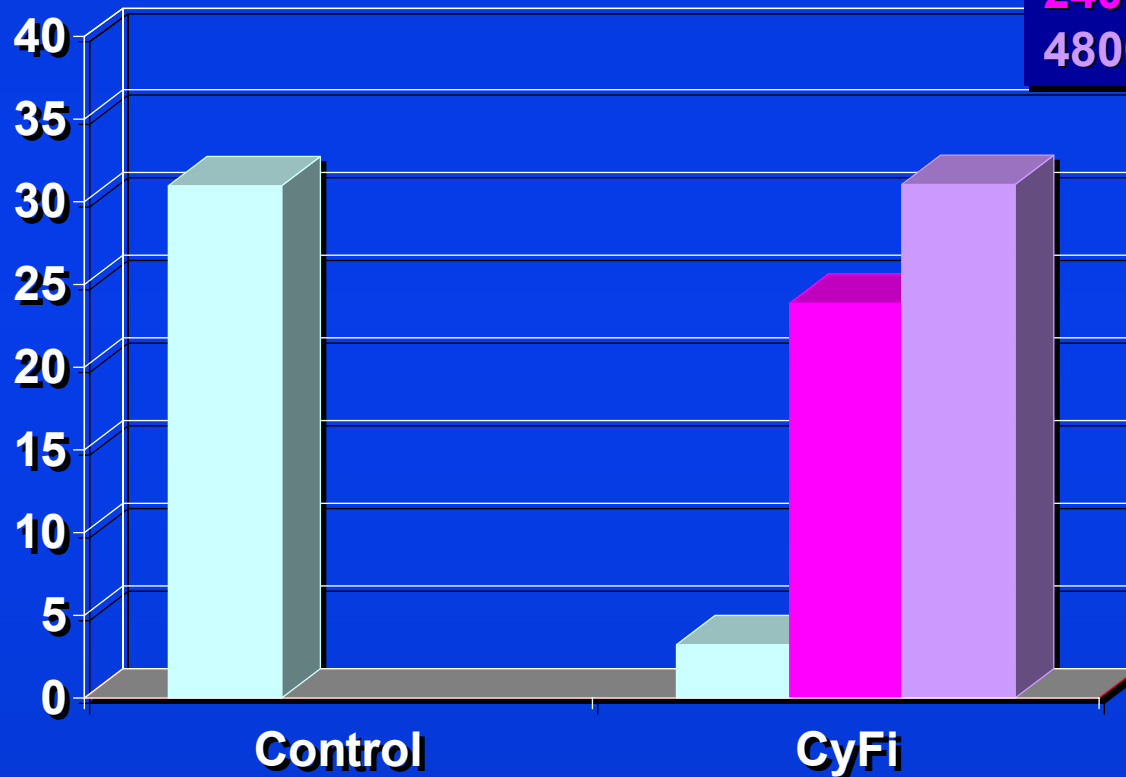
MALABSORPTION
SYNDROME
OTHER SOURCES

*Kahl S, Malfertheiner P.
Exocrine and endocrine pancreatic
insufficiency after pancreatic surgery.
Best Pract Res Clin Gastroenterol.
2004 Oct;18(5):947-55.*



^{13}C - MIXED TRIGLYCERIDE - ^{13}C -MTG BREATH TEST

cPDR ^{13}C



CF without enzyme therapy

2400 IU lipase/kg/food

4800 IU lipase/kg/food

10 mg/kg ^{13}C -MTG
cPDR 6 hours

*^{13}C Carbon mixed triglyceride breath test
and pancreatic enzyme supplementation in cystic fibrosis
Amarri S. et al.: Archives of Disease in Childhood 1997; 76: 349–351*



EXOCRINE PANCREATIC FUNCTION TESTS

^{13}C -breath test provides a **comprehensive assessment** of MTG digestive process - digestion of lipids

Values of cPDR ^{13}C -MTG test are **cummulative data**, which includes as well the **pancreatic function**, as **substitution therapy**

Cut-off value of cPDR ^{13}C -MTG test, lower limit of normals established by mathematical approximation is 30%

To assess exocrine pancreatic function testing is an appropriate **combination** of ^{13}C -MTG breath test and determination of faecal elastase 1, **affecting various aspects**

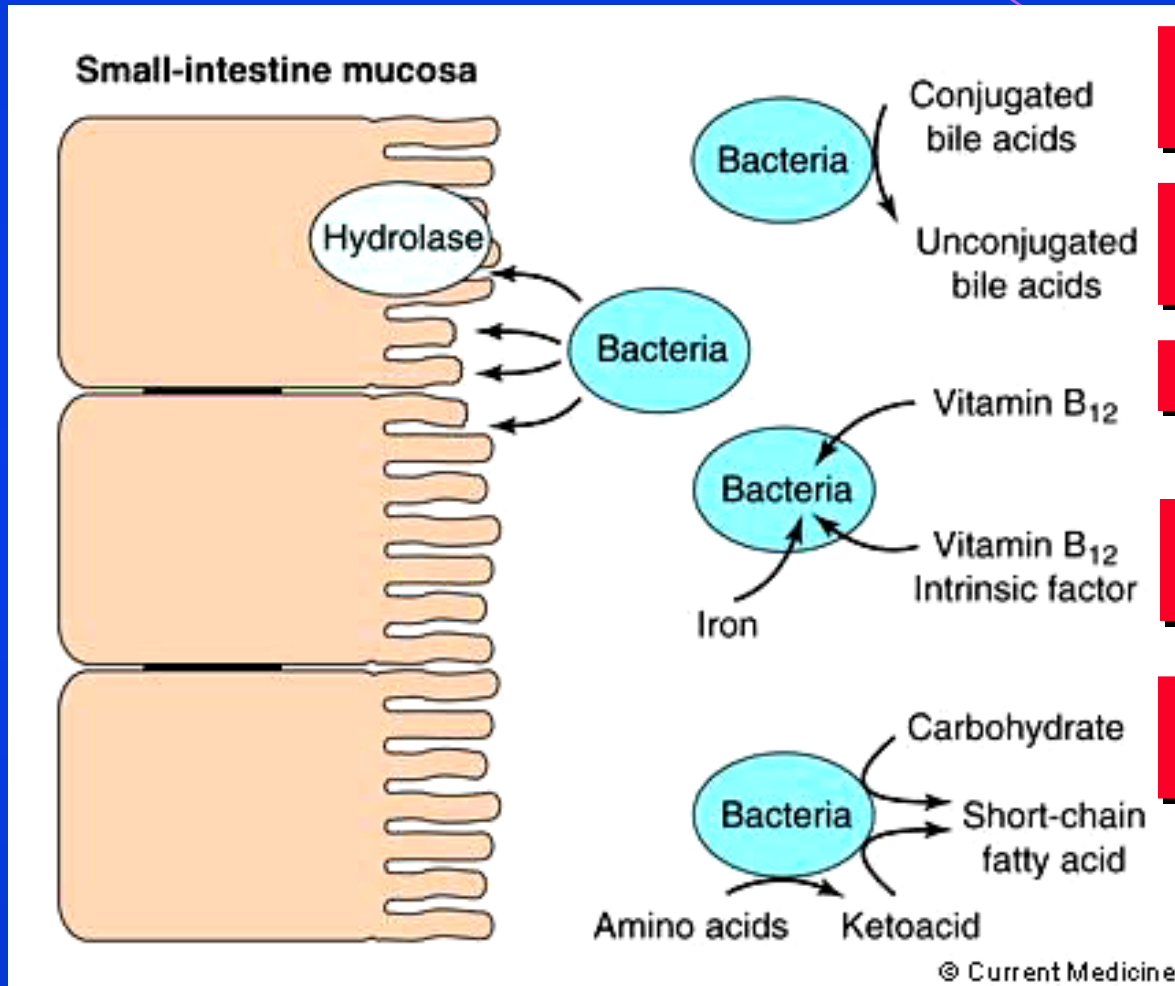
Economical benefit of exocrine pancreatic function tests is in possibility to exclude pancreatic substitution therapy in more than three-fourths patients with suspected pancreatic insufficiency.



MALABSORPTION-MALDIGESCE-MALASIMILATION
GIT FUNCTIONS
EXAMINATION METHODS
COELIAC DISEASE - GLUTEN ENTEROPATHY
LACTOSE INTOLERANCE
PANCREATIC INSUFFICIENCY
SMALL INTESTINAL BACTERIAL OVERGROWTH



SMALL INTESTINAL BACTERIAL OVERGROWTH



**BILE ACIDS
DECONJUGATION**

**HYDROLASE ACTIVITY
REDUCTION**

ENTEROCYTES DAMAGE

**B₁₂ AND IRON
CONSUMPTION**

**PRODUCTION OF
SHORT FATTY ACIDS**



<http://www1.lf1.cuni.cz/~kocna/glab/glency1.htm>

<http://gelab.zde.cz>

Skupina metodik funkce tenkého střeva, malabsorpce, screening celiakie, střevní propustnost, bakteriální přerůstání

Anti-endomysium IgA
Anti-gliadin IgA, IgG
Anti-tTG IgA, IgG
Anti-gliadin, tTG ve stolici
A-vitamin zátěžový test
β-karoten
β-karoten zátěžový test
Celiakie - screening
Dechový test s laktózou
Dechový test s xylózou
Laktózový toleranční test
Laktulózo/mannitolový test
Xylózový toleranční test

Intro

Abecední přehled metodik

MINIENCYKLOPEDIA laboratorních metod v gastroenterologii

GastroLab

ASOCIACE ZDRAVÝ NA INTERNETU

Protilátky ke tkáňové transglutamináze (atTG) - IgA a IgG

Tkáňová transglutamináza má přímý vztah k patogenezi onemocnění a byla popsána jako vlastní, chemický substrát endomysia. Tkáňová transglutamináza - (isoenzym transglutaminasa II, TG2 - EC 2.3.2.13, je transferázou, systémový název je protein-glutamin:amin-g-glutamyltransferasa. Je to Ca²⁺ dependentní enzym, katalyzující deaminaci glutaminu na glutamát, rovněž vede ke vzniku intramolekulární vazby glutaminu na další primární amin, např. lysin a vede k agregaci glutaminových peptidů. Stanovení protilátek ke tkáňové transglutamináze (atTG) má proto rovněž velmi vysokou diagnostickou efektivitu, podobně jako **EmA protilátky** (senzitivita 87-97% a specifita 88-98%). Stanovení atTG je prováděno klasickou metodou ELISA, což je pro rutinní diagnostiku technika dostupnější než imunofluorescenční průkaz EmA.

Protilátky atTG lze na rozdíl od EmA stanovit ve třídě IgA i IgG, což má význam pro nemocné se selektivním deficitem IgA. Metoda byla popsána s použitím morčecího antigenu, který je použit ve většině starších souprav, novější soupravy již používají jako antigen tkáňovou transglutaminázu izolovanou z lidských buněk, z lidských erytrocytů, nebo rekombinantní tTG izolovanou na E.coli. Referenční hodnoty se liší u jednotlivých souprav, většinou je pro IgA protilátky uváděna horní hranice normy 10 - 15 IU/l, některé soupravy definují i tzv. gray-zone v rozsahu 10 - 20 IU/l. Stanovení protilátek atTG s lidským, rekombinantním antigenem vykazuje nižší falešnou pozitivitu než metody s morčecím antigenem. Nejnovější studie porovnávají protilátky třídy IgA a IgG, a POCT metodiky stanovení atTG protilátek. Stanovení protilátek atTG ve třídě IgA je doporučeno jako základní screeningový test pro diagnostiku **celiakie**. Pro screening byla v roce 2011 použita i technologie detekce atTG ve slinách, a nejnovější studie popisují zcela nové technologie detekce protilátek elektrochemickými imunosenzory.

Reference
Volta U. - Gastroenterol Hepatol Bed Bench. 2023, [Medline - link](#) [PubMed](#)
Infantino M. - J Immunol Meth. 2021, [Medline - link](#) [PubMed](#)

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Direct link to MZČR
National code



THANK YOU FOR

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