



**Nuove Frontiere  
nella Nutrizione Clinica**  
**Levico Terme 13-14 Aprile 2012**

**ADI**  
Associazione Italiana di Dietetica e Nutrizione Clinica - ONLUS  
Federata FISSV - Sezione Teramo Alto Adige

**Nuove frontiere  
nella Nutrizione Clinica**

13 - 14 aprile 2012  
Palalevico, Levico Terme (TN)

***La fibra nel post-operato  
all'intestino***

**Paolo Pallini**  
**UOS Aziendale di Dietetica e Nutrizione Clinica**

**Venezia - Mestre**

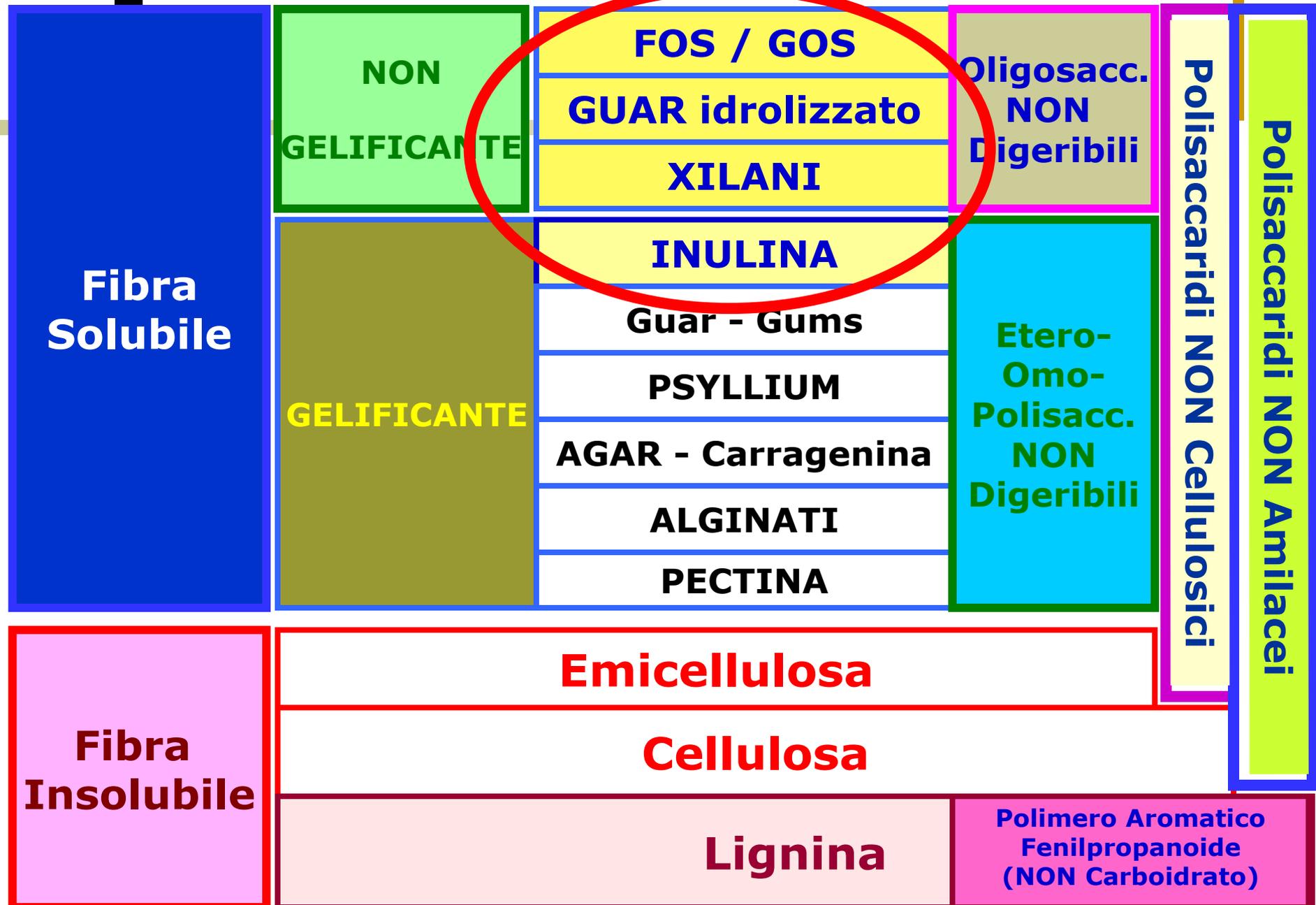


- 
- ✓ Fibra "alimentare"
  - ✓ Intestino "sano" & "malato"
  - ✓ Intestino "operato"

# ***Fibra alimentare***

- ✓ Il termine comprende una ampia varietà di sostanze che appartengono alla *famiglia dei carboidrati,*
- ✓ e sono *resistenti all'idrolisi degli enzimi digestivi umani,*
- ✓ ma sono *fermentati dai batteri intestinali del colon.*

# Classificazione della "fibra"



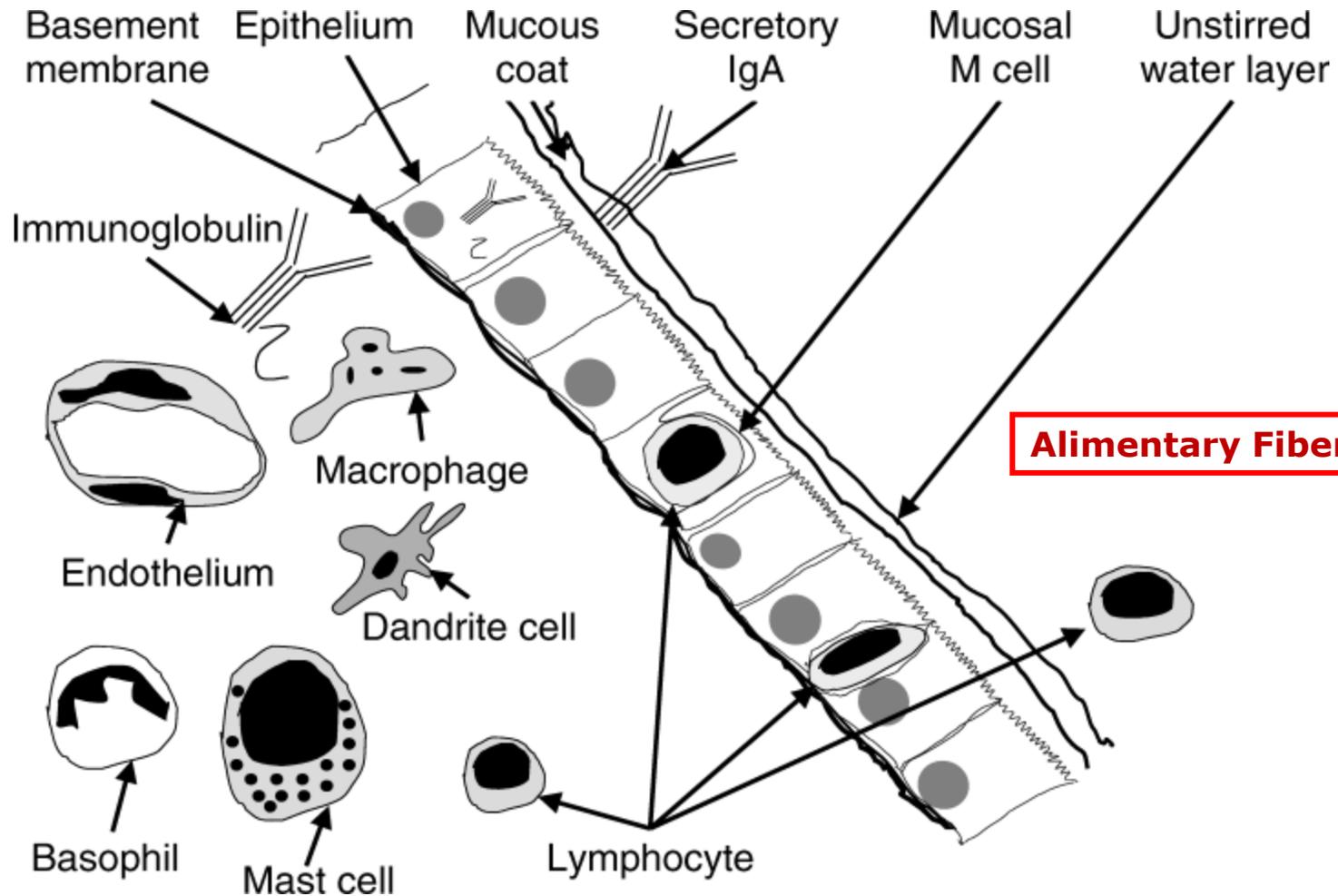
# ***Azioni della fibra***

- Migliora la tolleranza glucidica**
- Riduce la digestione dell'amido**
- Aumenta la biomassa batterica**
- Riduce il pH del colon**
- Aumenta la produzione di SCFA**
- Aumenta la massa fecale**

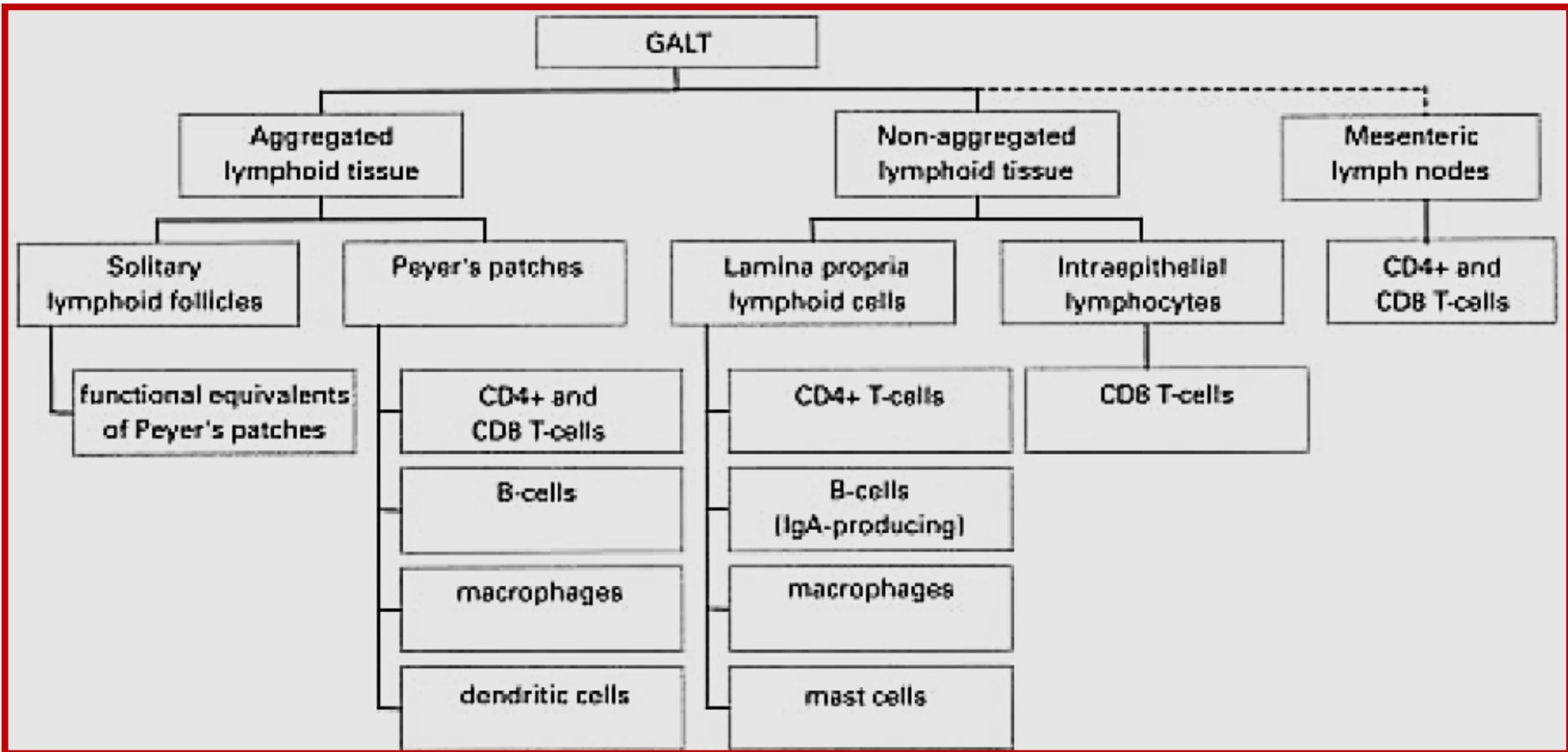
- ✓ Fibra "alimentare"
- ✓ Intestino "sano" & "malato"
- ✓ Intestino "operato"

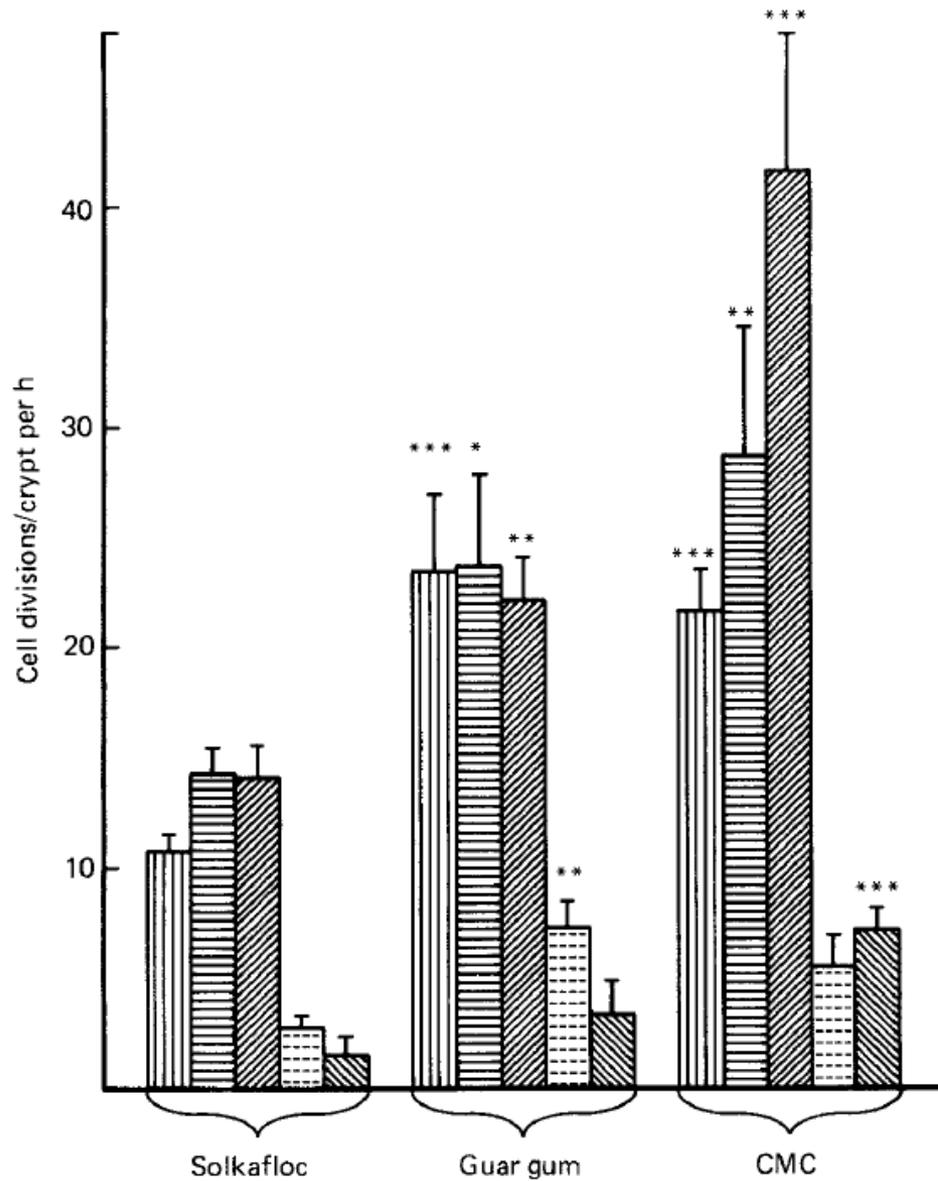
# Barriera Intestinale

A. Farhadi, A. Banan, J. Fieldsand and A.Keshavarzian J. Gastroenterology and Hepatology 2003



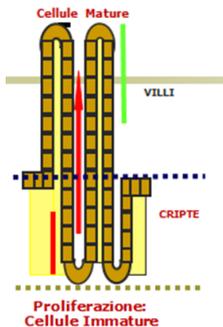
# Gut Associated Lymphoid Tissue (GALT)







Diet ...	SF		CMC		Statistical significance of differences SF v. CMC
	Mean	SE	Mean	SE	
<b>Proximal jejunum</b>					
Cell division rate (divisions/crypt per h)	11.7	1.3	19.8	1.6	**
Villous height ( $\mu\text{m}$ )	624	19	631	21	NS
Villous width ( $\mu\text{m}$ )	601	36	709	25	*
Crypt length ( $\mu\text{m}$ )	136	5	210	5	***
<b>Distal ileum</b>					
Cell division rate (divisions/crypt per h)	11.4	1.5	35.5	3.9	***
Villous height ( $\mu\text{m}$ )	313	14	299	10	NS
Villous width ( $\mu\text{m}$ )	367	20	456	13	**
Crypt length ( $\mu\text{m}$ )	151	4	279	8	***



NS, not significant.

\*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ .

***I.T. Johnson and J.M. Gee - British Journal of Nutrition 1986***

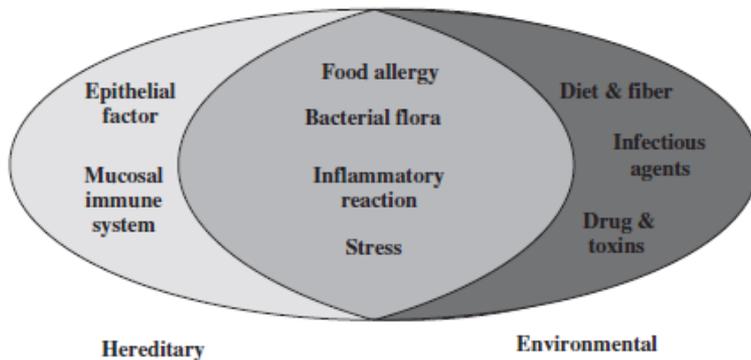
Diet ...	SF		G		CMC		Statistical significance of differences		
	Mean	SE	Mean	SE	Mean	SE	SF v. G	SF v. CMC	G v. CMC
Length of small intestine (mm)	1130	20	1330	20	1350	20	***	***	NS
Wt of caecum (g wet wt)	0.65	0.02	1.85	0.05	2.45	0.11	***	***	***
Wt of caecal contents (g wet wt)	2.01	0.13	4.26	0.27	11.06	0.73	***	***	***
Wt of caecal contents (g dry wt)	0.64	0.02	0.74	0.05	1.85	0.13	NS	***	***
Dry matter content of caecal contents (g/kg)	315	7	175	10	167	2	***	***	NS

NS, not significant.

\*\*\*  $P < 0.001$ .

*I.T. Johnson and J.M. Gee - British Journal of Nutrition 1986*

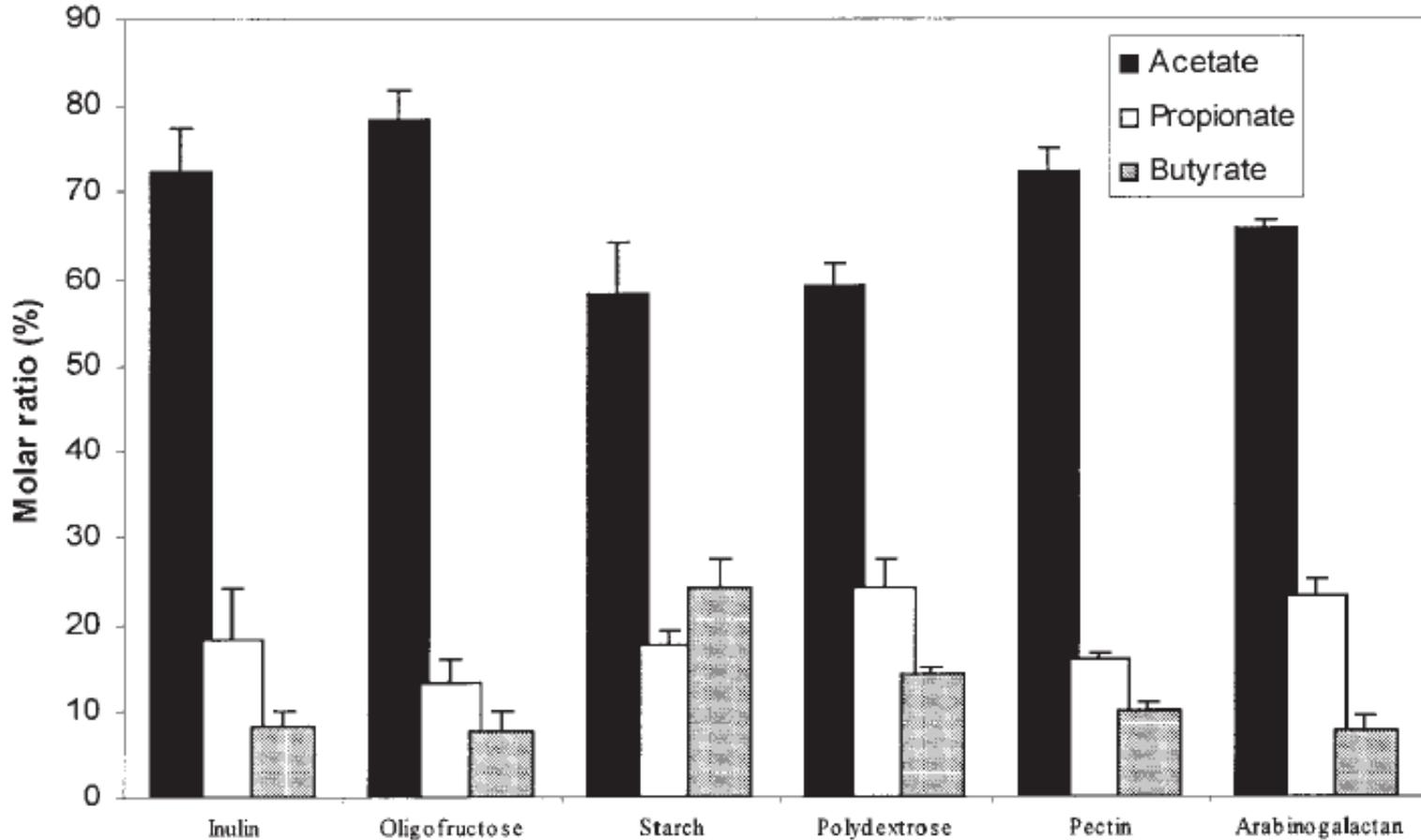
# Barriera Intestinale



- ☑ ↓ traslocazione batterica
- ☑ ↑ funzione di barriera in corso di TPN
- ☑ ↓ lesioni da alcool
- ☑ ↓ lesioni da 5-FU

*A. Farhadi, A. Banan, J. Fieldsand and A.Keshavarzian J. Gastroenterology and Hepatology 2003*

# **% di SCFA prodotta**



***J.H. Cummings, G.T. Macfarlane, and H.N. Englyst Am J Clin Nutr 2001***

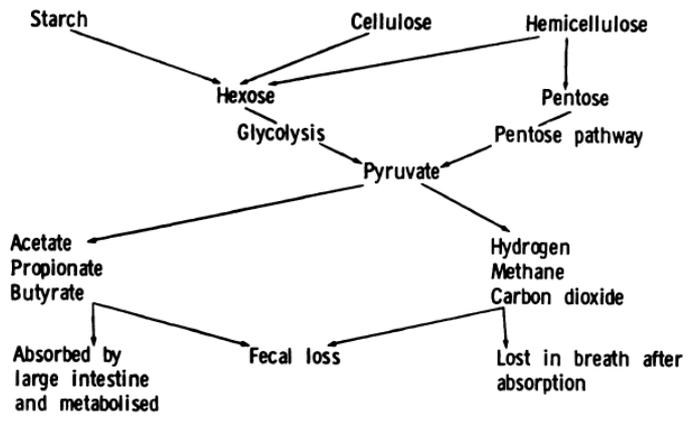


ENTERS LARGE  
INTESTINE

METABOLIZED BY  
BACTERIA FOR  
BACTERIAL GROWTH

END PRODUCTS

FATE



- ✓ 60 g carboidrati /die
- ✓ 600 mmol di SCFA
- ✓ 750 J (=178,99 kcal)
  
- ✓ 75% contenuto energetico
- ✓ 25% utilizzato dalla flora batterica
  
- ✓ 20 mmol di SCFA output fecale
  
- ✓ 9-10% del fabbisogno energetico

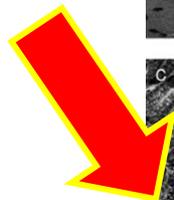
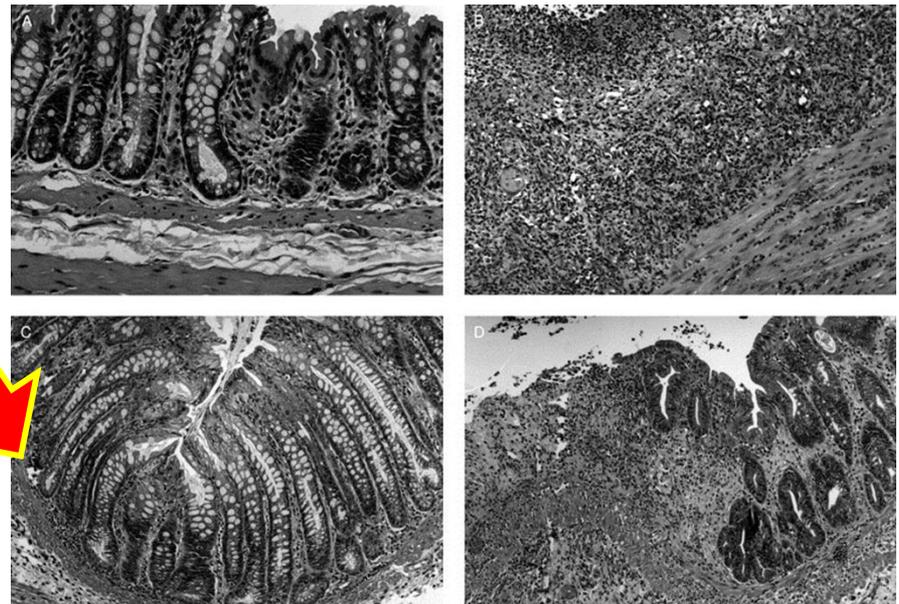
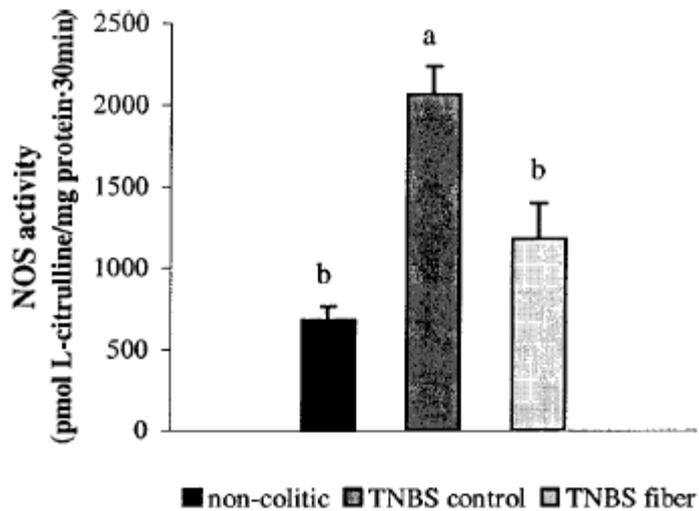
**NI McNeil, The American Journal of Clinical Nutrition 39: 1984**

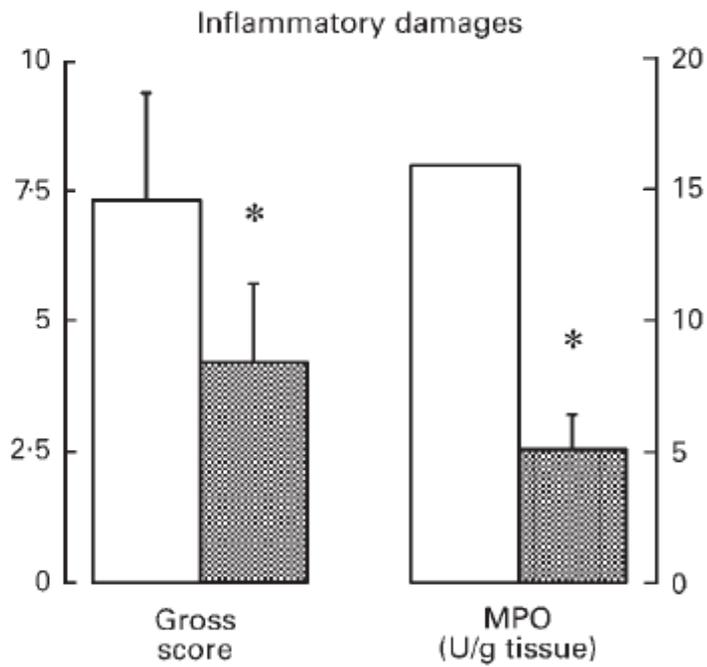
**Paolo Pallini - 2012**

Reference	Subjects	Experimental fibre	Control diet/fibre	Immune effects
Field <i>et al.</i> 1999	Adult mongrel dogs	Fermentable fibre mixture (beet pulp, oligofructose*, gum arabic), 8.7 g/kg	cellulose, 8.3 g/kg	↑ CD8+ cells in IEL, PP and LP ↑ CD4+ cells in MLN and peripheral blood Higher T cell mitogen responses in MLN and IEL
Gaskins <i>et al.</i> 1996 Kaufhold <i>et al.</i> 2000	C57BL/6NHsd mice Veal calves	Oligofructose*, 30 g/l drinking water Oligofructose*, 10 g/d	Ensure® (low residue) whole-milk based cellulose, 5% w/w	↑ cecal and colonic macrophages ↑ eosinophil granulocytes in blood
Kudoh <i>et al.</i> 1998	Sprague-Dawley rats	Arabic gum, celfur, lactulose†, or purified indigestible dextrin, 5% w/w		↑ κ-light chain- and IgA-positive cells in small intestine and cecal mucosa (all fibres) ↓ CD4+:CD8+ ratio in spleen (celfur, lactulose) ↓ CD3+ cells in spleen (arabic gum)
Kudoh <i>et al.</i> 1999	Sprague-Dawley rats	Celfur, glucomannan, curdlan, or lactulose†, 5% w/w	cellulose, 5% w/w	↑ IgA-positive cells in cecum (celfur, lactulose)
Lim <i>et al.</i> 1997	Sprague-Dawley rats	Pectin, konjak mannin, or chitosan, 5% w/w	cellulose, 5% w/w	↑ IgA secretion into cecal contents (all fibres) ↓ serum and MLN IgE (all fibres) ↑ serum IgA and IgG (pectin) ↑ MLN IgA and IgG (pectin, chitosan) ↑ CD4+ T cells in MLN (pectin) ↑ INF-γ in MLN (pectin)
Madar <i>et al.</i> 1998	Sprague-Dawley rats (tumour-bearing)	Cellulose, white grape, or tomato peel, 15% w/w	cellulose, 3% w/w	↑ area of lymphoid infiltrates in colonic mucosa close to tumor (white grape, tomato peel) ↑ Ki-67+ cells in colonic mucosa and tumors (all fibres)
Nagai <i>et al.</i> 2000 Nagendra & Venkat Rao, 1994	Wistar/ST rats Wistar rats	Sugar beet fibre, 10% w/w Lactulose †, 0.5% of energy	fibre-free infant formula	↑ CD8+ IEL in colorectum ↑ phagocytic function of intraperitoneal macrophages
Pierre <i>et al.</i> 1997	Min mice	Oligofructose (from sucrose)*, wheat bran, or resistant starch, 5.8% w/w	cellulose, 2% w/w	↑ number of PP in small intestine (short-chain FOS)
Yamada <i>et al.</i> 1999	Sprague-Dawley rats	PHGG, guar gum, HM pectin, or glucomannan, 5% w/w	cellulose, 5% w/w	↑ IgA in spleen and MLN (all fibres) ↑ IgG in spleen (glucomannan, pectin) and MLN (all fibres) ↑ serum IgA (guar gum, glucomannan, pectin) and IgM (glucomannan)
Yun <i>et al.</i> 1997	C57BL/6 mice (immunosuppressed)	Oat β-glucan, 3 mg every 48 h	Diet not specified	↑ non-specific and antigen-specific IgG in serum
Yun <i>et al.</i> 1998	C57BL/6 mice	Oat β-glucan, 3 mg every 48 h	diet not specified	↑ IFN-γ and IL-4-secreting cells in spleen and MLN ↑ intestinal antigen-specific IgA ↓ IL-4 secreting cells in MLN
Zusman <i>et al.</i> (1998)	Rats	Cellulose, white grape or tomato peel, 15% w/w	cellulose, 3% w/w	↑ plasma cells in splenic red pulp (all fibres)

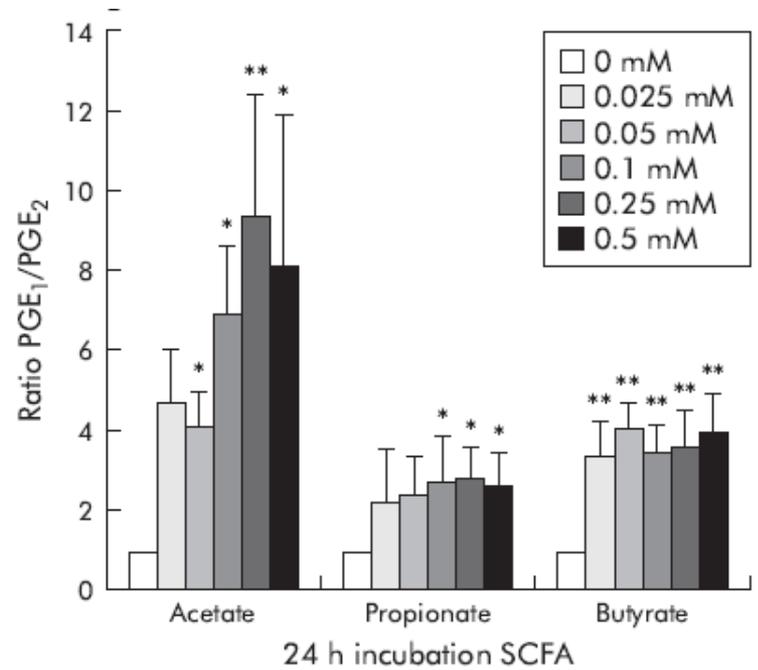
Frontiers in Nutrition & Nutrition Science - 2012  
Volume 1(2) - Nutrition Science 101-110

Group	MPO activity <sup>2</sup>	GSH	LTB <sub>4</sub>	TNF $\alpha$
	<i>units MPO/g</i>	<i>nmol/g</i>	<i>ng/g</i>	<i>pg/g</i>
Noncolitic	86 $\pm$ 11 <sup>c</sup>	1756 $\pm$ 35 <sup>a</sup>	2.34 $\pm$ 0.59 <sup>b</sup>	131 $\pm$ 19 <sup>b</sup>
TNBS control	562 $\pm$ 62 <sup>a</sup>	1355 $\pm$ 96 <sup>b</sup>	7.79 $\pm$ 0.54 <sup>a</sup>	600 $\pm$ 127 <sup>a</sup>
TNBS fiber	325 $\pm$ 43 <sup>b</sup>	1648 $\pm$ 69 <sup>a</sup>	9.87 $\pm$ 2.46 <sup>a</sup>	223 $\pm$ 49 <sup>b</sup>

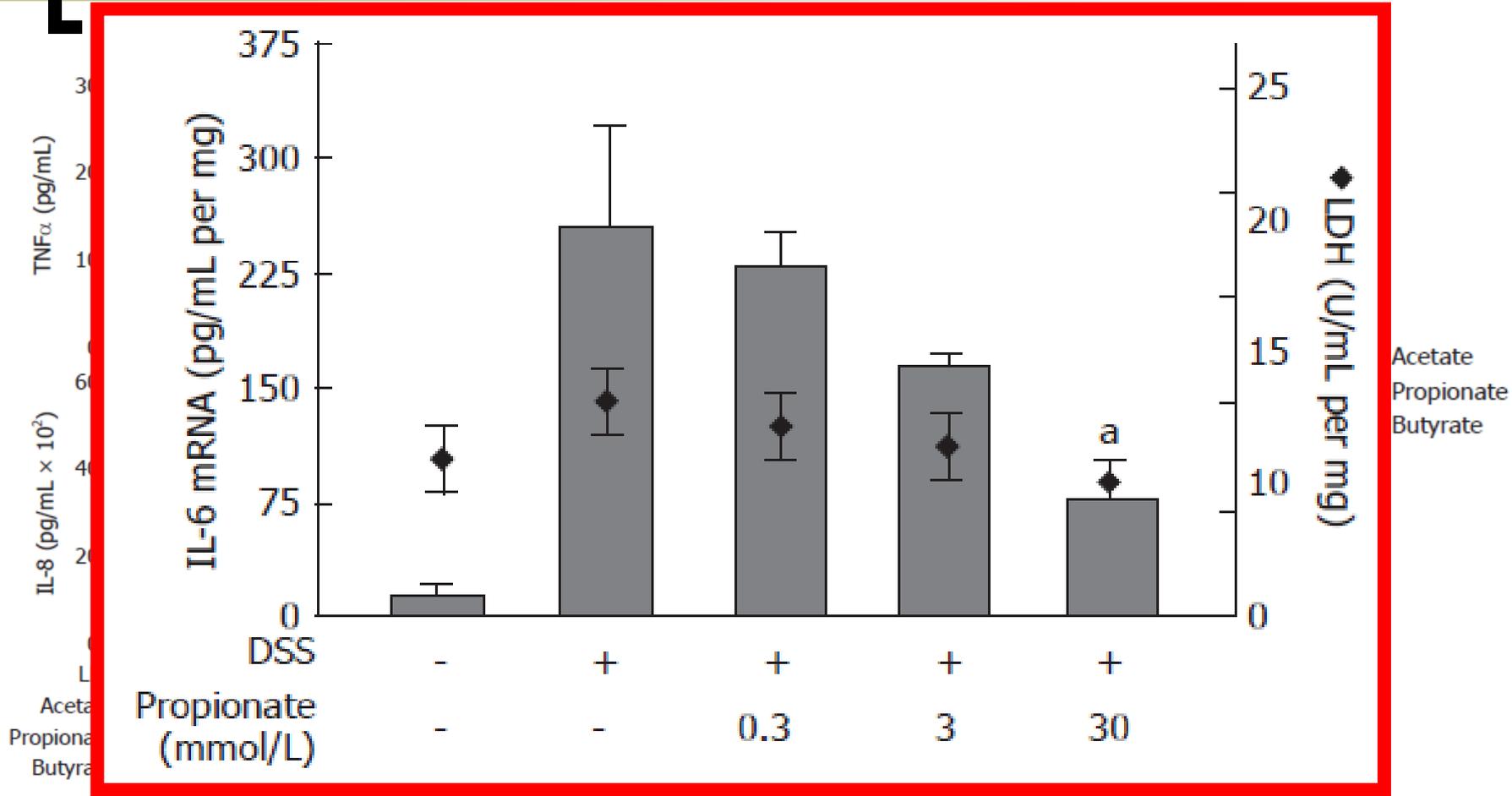




**C. Cherbut *British Journal of Nutrition* 2002**



**L E M Willemsen et al. *Gut* 2003**



*S.Tedelind, F. Westberg, M. Kjerrulf, A. Vidal World J Gastroenterol 2007*

*Paolo Pallini - 2012*

# ***Fibra & Barriera Intestinale***

- Trofismo della mucosa
- Attività ghiandolare
- GALT
- Risposta immune
- Risposta infiammatoria
- Funzione di barriera

- ✓ Fibra "alimentare"
- ✓ Intestino "sano" & "malato"
- ✓ Intestino "operato"

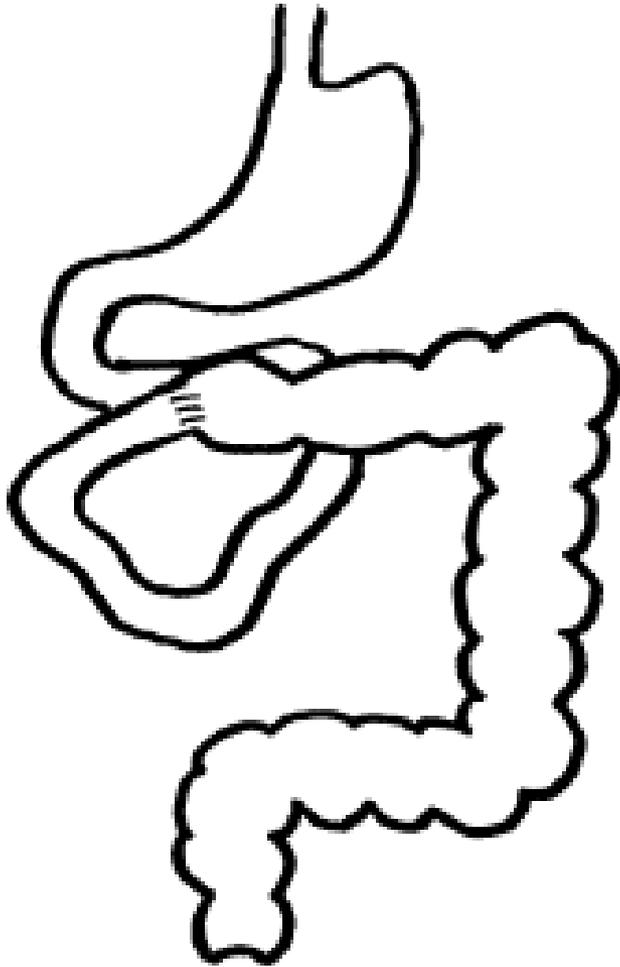
# ***Short Bowel Syndrome (SBS)***

- ✓ SBS è una situazione di malassorbimento che segue ad una massiva resezione del piccolo intestino
- ✓ SBS è la causa più frequente di Insufficienza Intestinale (IIB)
- ✓ Criticità: "Capacità assorbitiva"  
resezione anatomica & Insufficienza funzionale

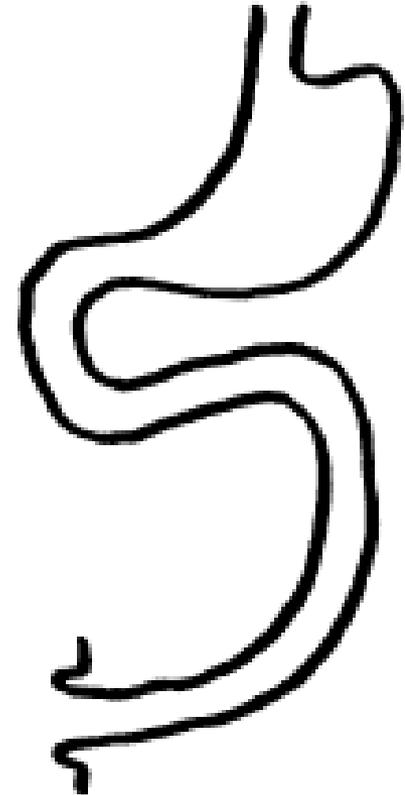
## **Diagnosis:**

- ✓ Anamnesi (cartelle cliniche con atto chirurgico)
- ✓ Imaging (con contrasto)
- ✓ Endoscopia (tratto superiore e/o inferiore)
- ✓ Livello serico di citrullina (Capacità assorbitiva)
- ✓ Tolleranza ad Alimenti e/o Nutrizione Enterale

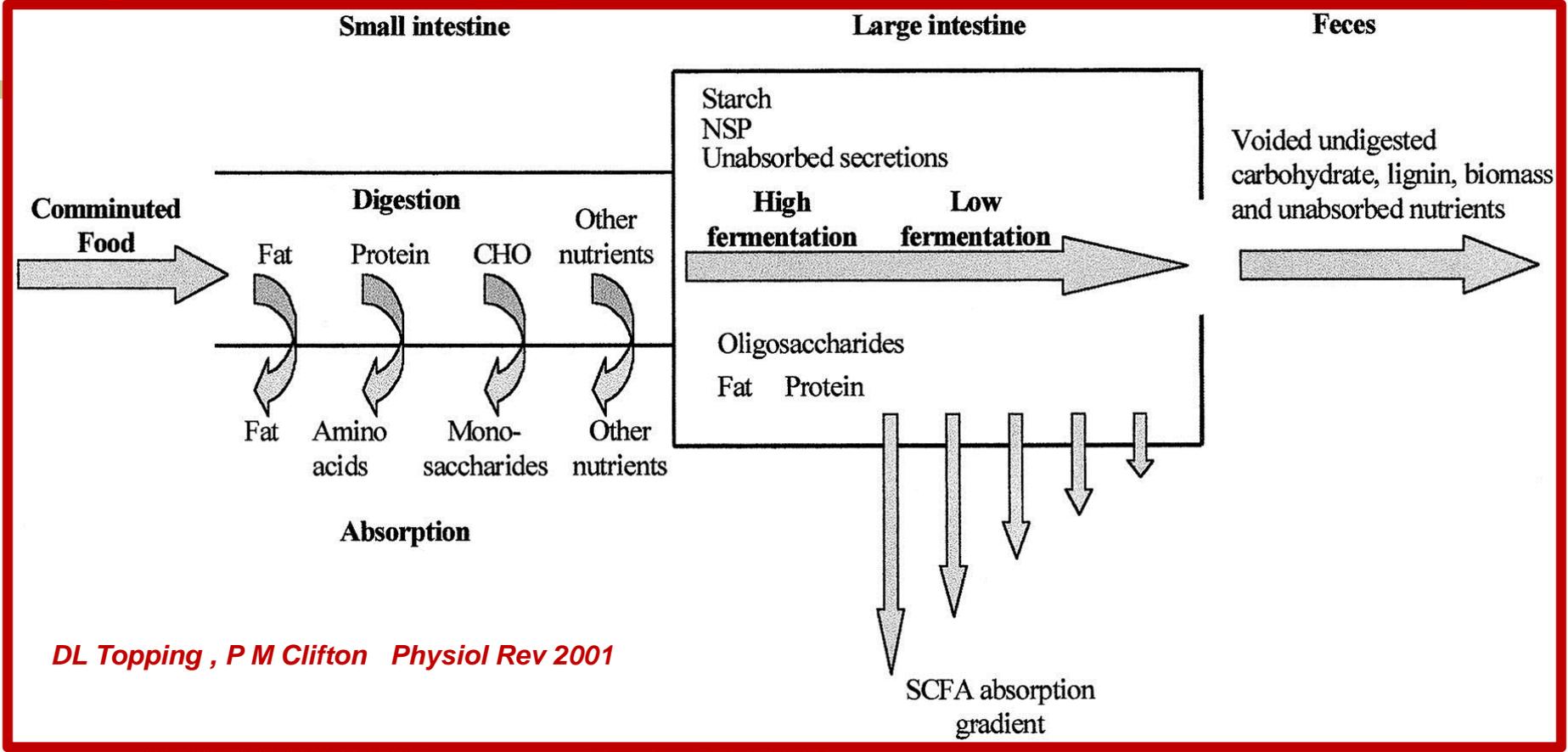
## Jejuno-colic anastomosis



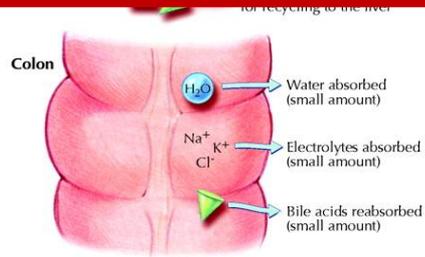
## Jejunostomy



Nutrients combined with salivary amylases



to water secretion and diarrhea. There is also malabsorption of vitamin B<sub>12</sub>. In addition, there is loss of energy in the form of increased fat loss. However, as the length of the resection increases, there is malabsorption of all macronutrients, namely, fat, carbohydrate and protein. The malabsorbed carbohydrate entering the colon is fermented to produce flatulence and diarrhea. In addition, there is malabsorption of vitamins and trace elements such as zinc.



**Colon:**

Water & electrolyte  
Short Chain Fatty Ac.

Jejunal length (cm)	Jejunum-colon	Jejunostomy
0-50	PN	PN+PS
51-100	ON	PN+PS*
101-150	None	ON+OGS
151-200	None	OGS

\*:at 85-100 cm may need PS only

PN:Parenteral nutrition

PS:Parenteral saline (+/-magnesium)

ON:Oral (or enteral) nutritinon

OGS:Oral (or enteral) glucose/saline solution

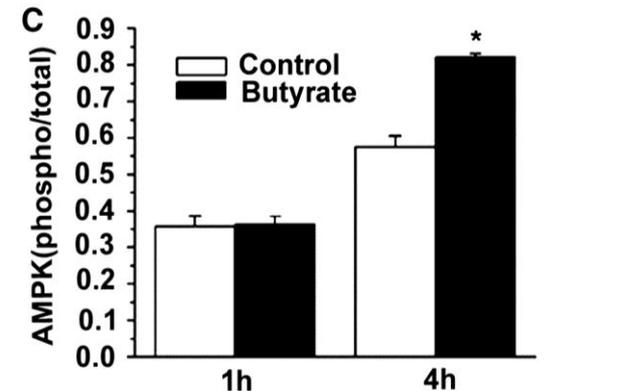
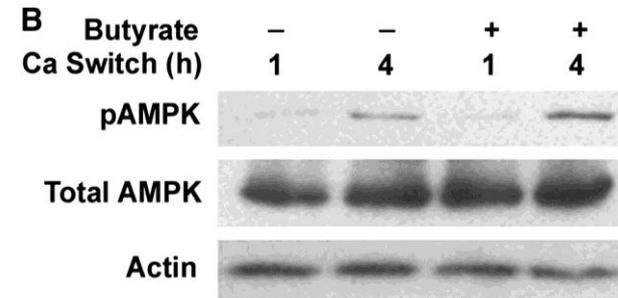
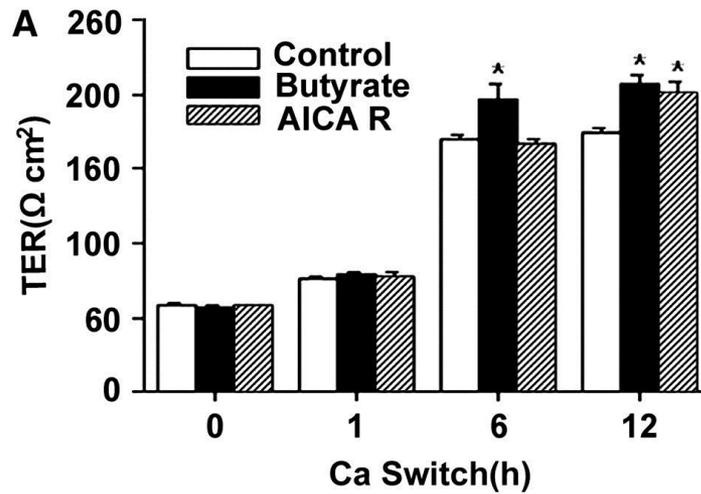
***JMD Nightingale World J Gastroenterol 2001***



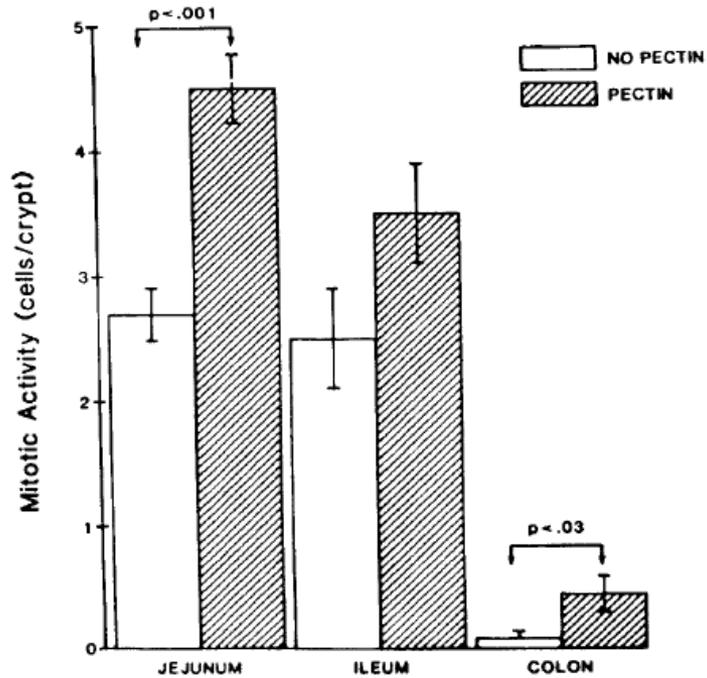
	Colon Presente	Colon Assente
<p><b>A 2% pectin-enriched elemental diet led to a significant increase</b></p> <p><b>in intestinal weight, mucosal protein content, and mucosal DNA content</b></p> <p><b>in rats with an 80% small bowel resection</b></p> <p><i>C.F.E. Platell et al. World J Gastroenterol 2002</i></p>		
Liquidi	ORS, soluzione ipotoniche	ORS

***JK DiBaise, RJ Young & JA Vanderhoof Am J Gastroenterol. 2004***

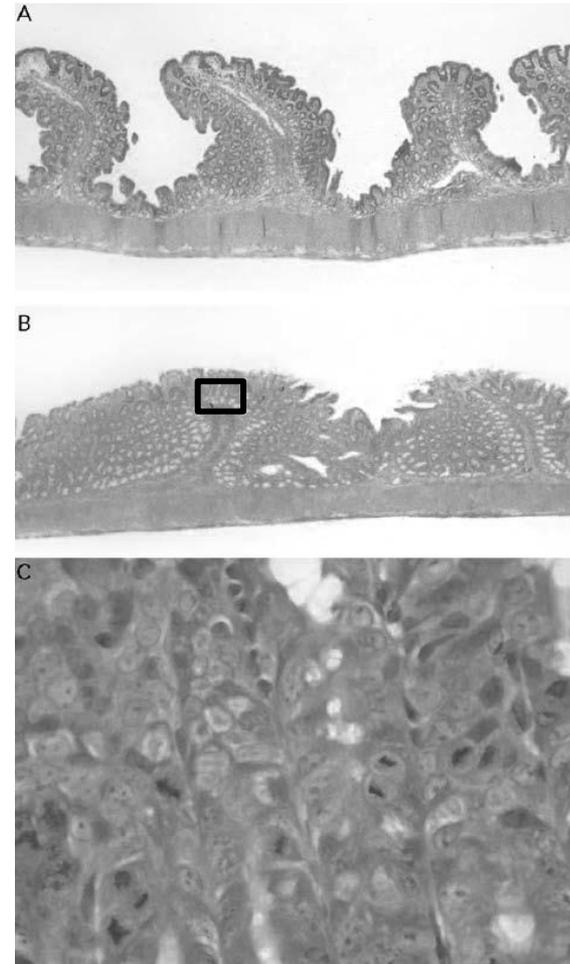
# Butirrato & Tight junctions



# Adattamento Intestinale



**M.J. Koruda et al. JPEN 1986**



# ***Il futuro... Fibre/intestino operato***

- ✓ Pochi dati sull'uomo
- ✓ Dati sperimentali
  - ✓ Adattamento
  - ✓ Funzione
  - ✓ Morfologia
- ✓ Tollerabilità





**Grazie**

[

]