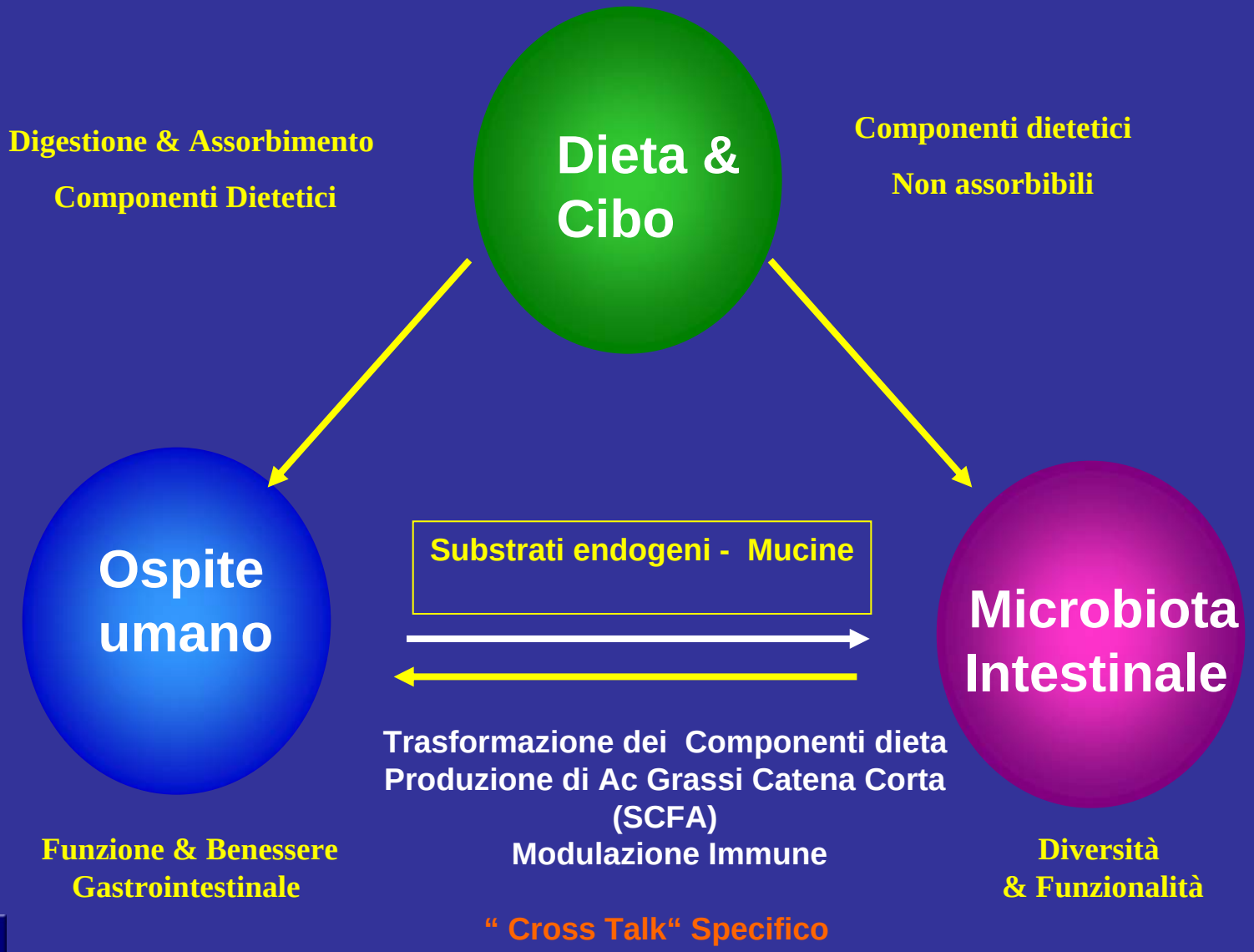
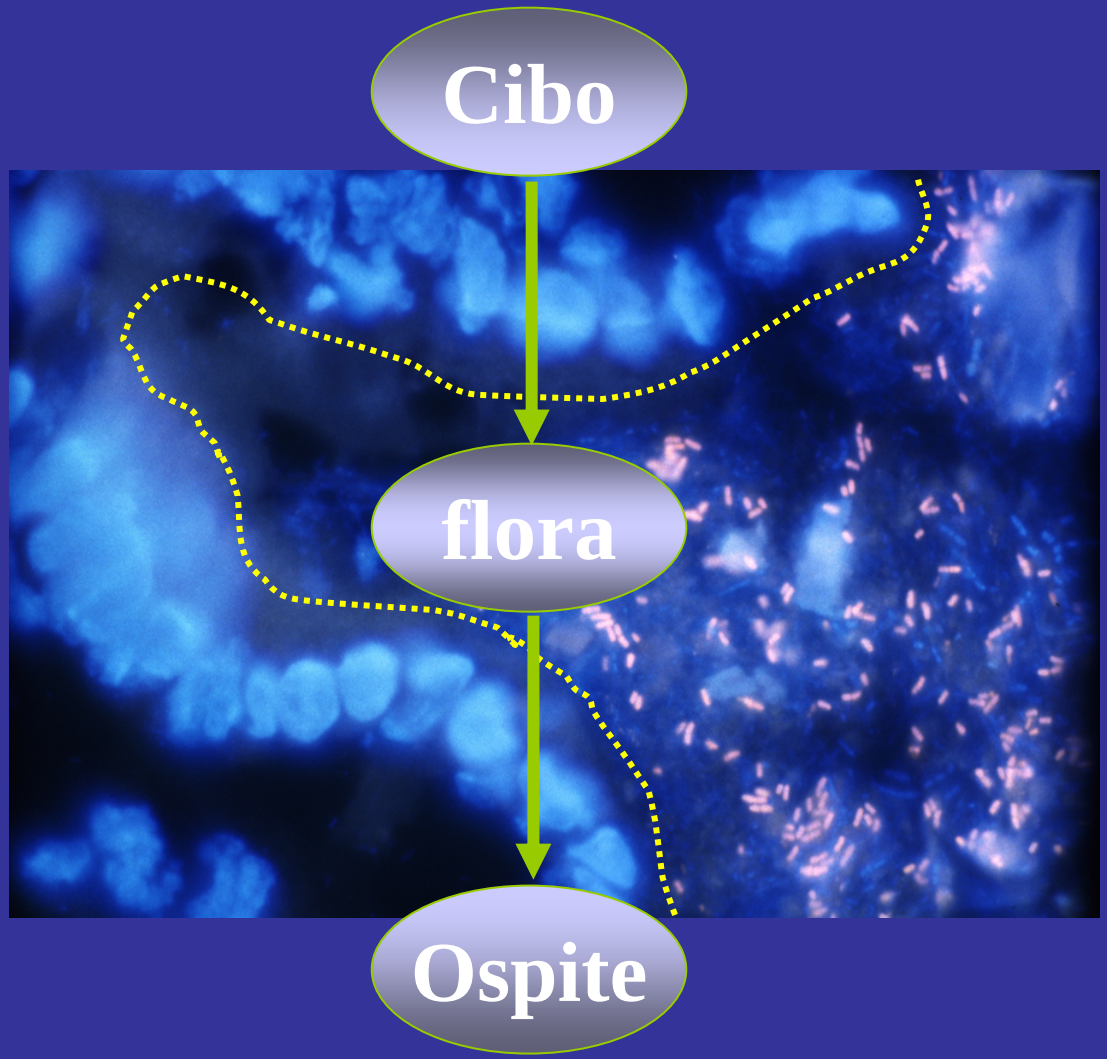


Probiotici e Prebiotici

IL TRIANGOLO DEL BENESSERE

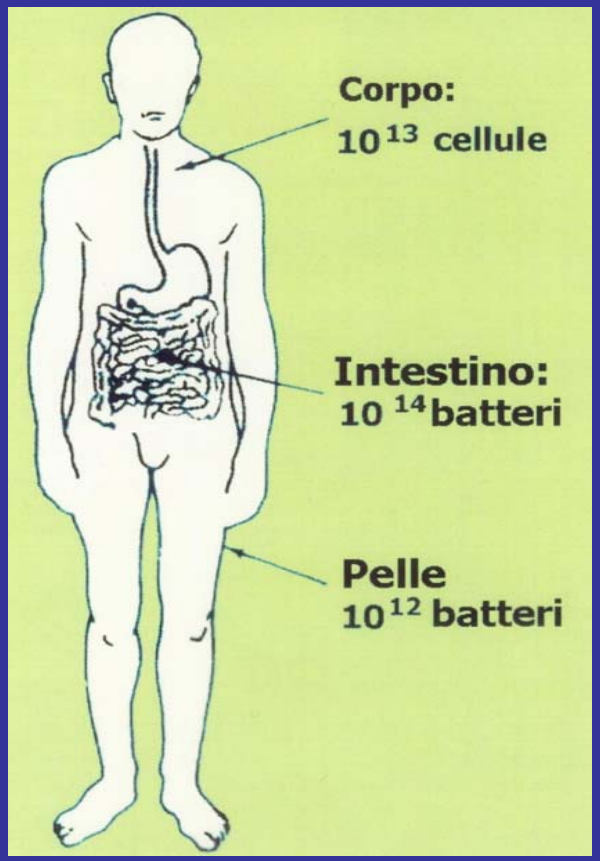


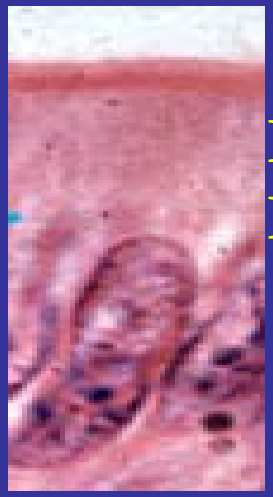


Salute <-> Malattia

Il concetto di partenza

- Il corpo umano ha siti in cui la presenza dei batteri è favorita, ma anche zone di assenza dei batteri.
- Ospitiamo più cellule batteriche che cellule tissutali!



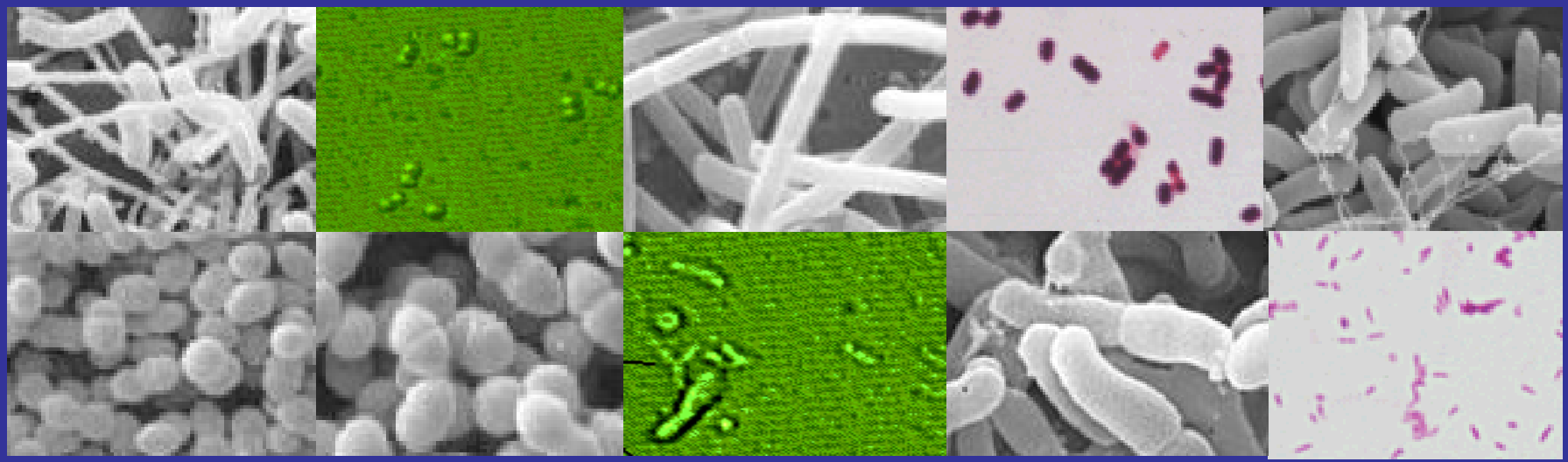


Human Enterocyte

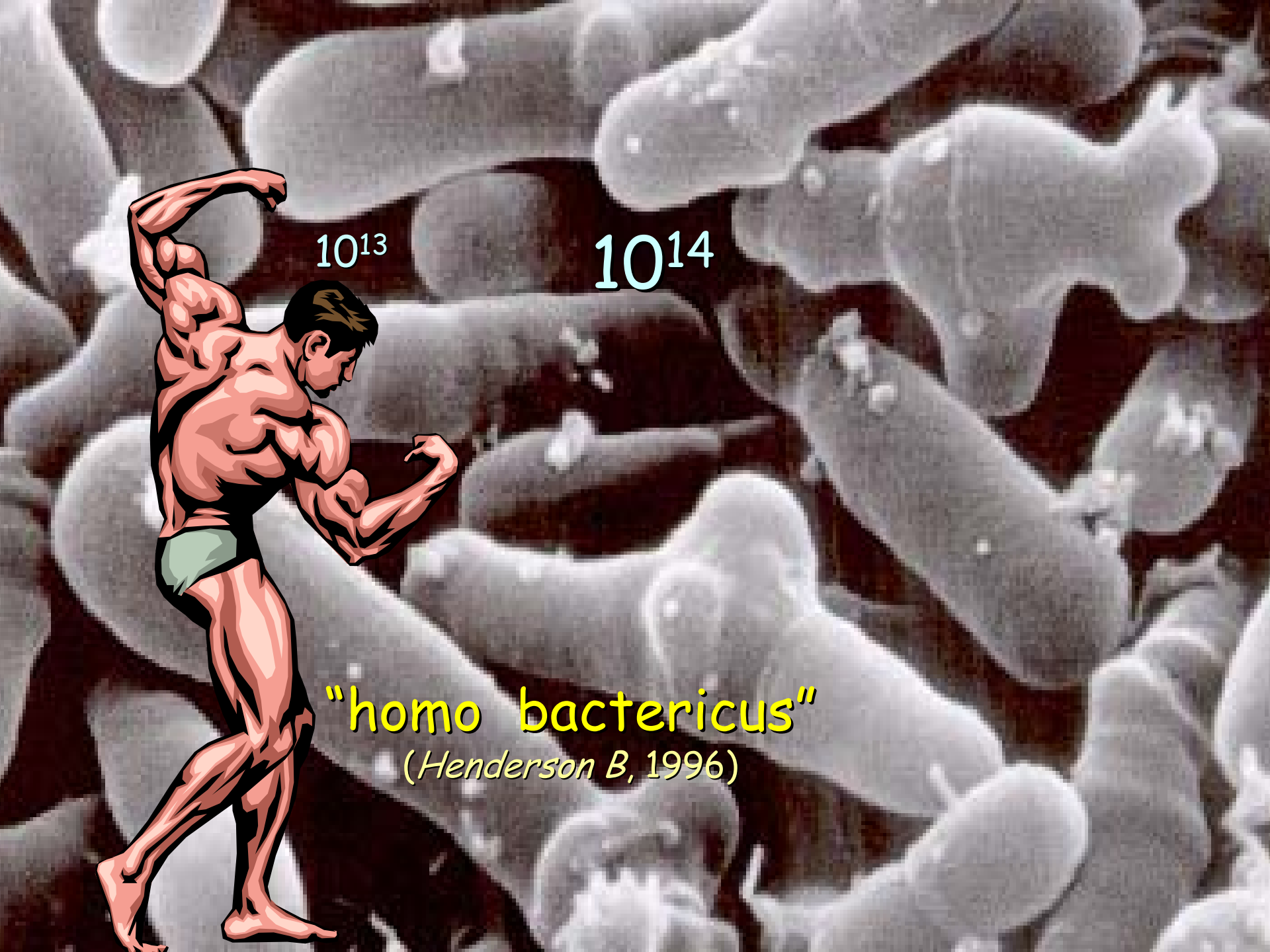
Host Cell : Intestinal Bacteria 1 : 10

500 strains in 10^{11} bacteria /g intestine content

L.casei *L.plantarum* *L.bulgaricus* *C.perfringens* *E.coli*



S.faecalis *S.faecium* *B.bifidum* *B.breve* *Bacteroides*


10^{13}
10^{14}
"homo bactericus"
(Henderson B, 1996)

PROBIOTICI: DEFINIZIONE ORGANISMI INTERNAZIONALI

- **FAO/WHO 2001: Microrganismi vivi che,se somministrati in quantità adeguata,hanno un effetto benefico per l'ospite**
- **PROEUHEALTH 2002: Ingredienti microbici vivi per alimenti,o nutraceutici, inclusi per favorire la salute del consumatore**

MINISTERO SALUTE 2002:Alimento integrato con microrganismi vivi ad effetto benefico per la salute

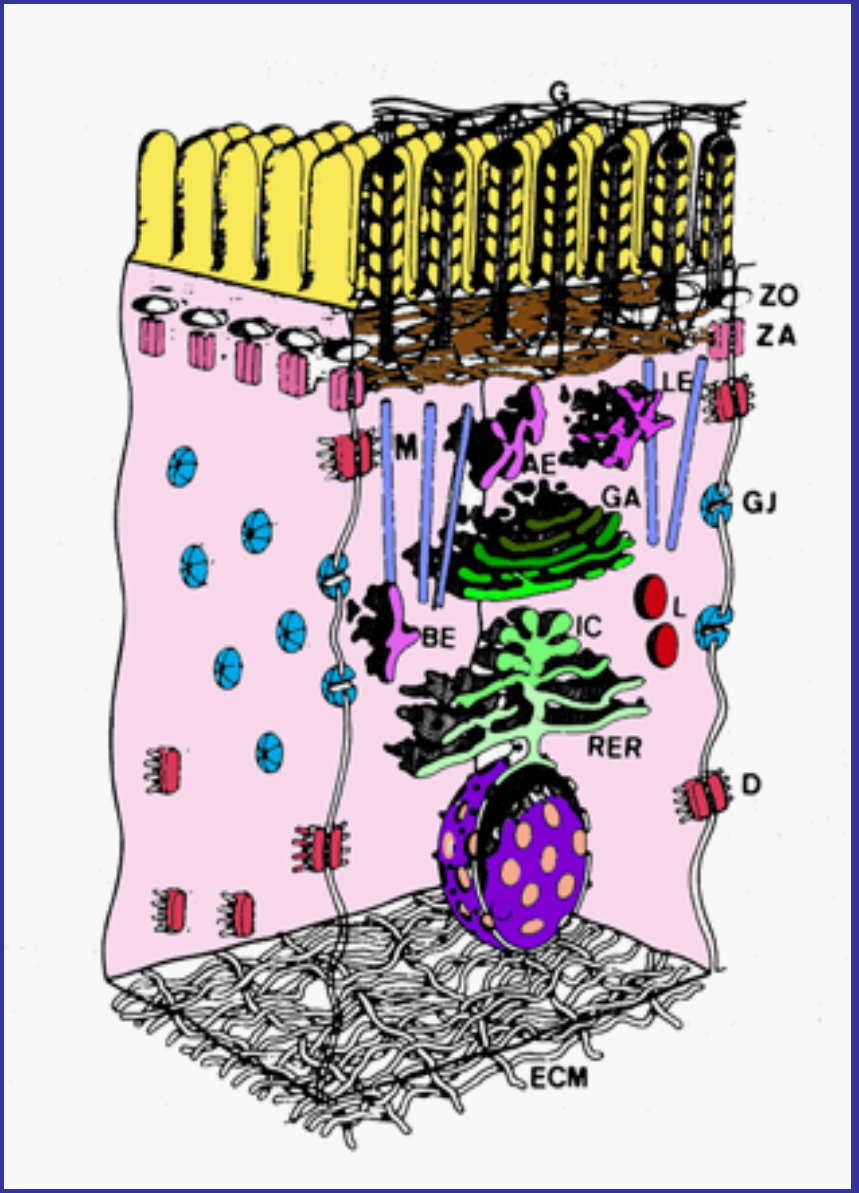
PROBIOTICI: MECCANISMI DI AZIONE

Competizione per substrati

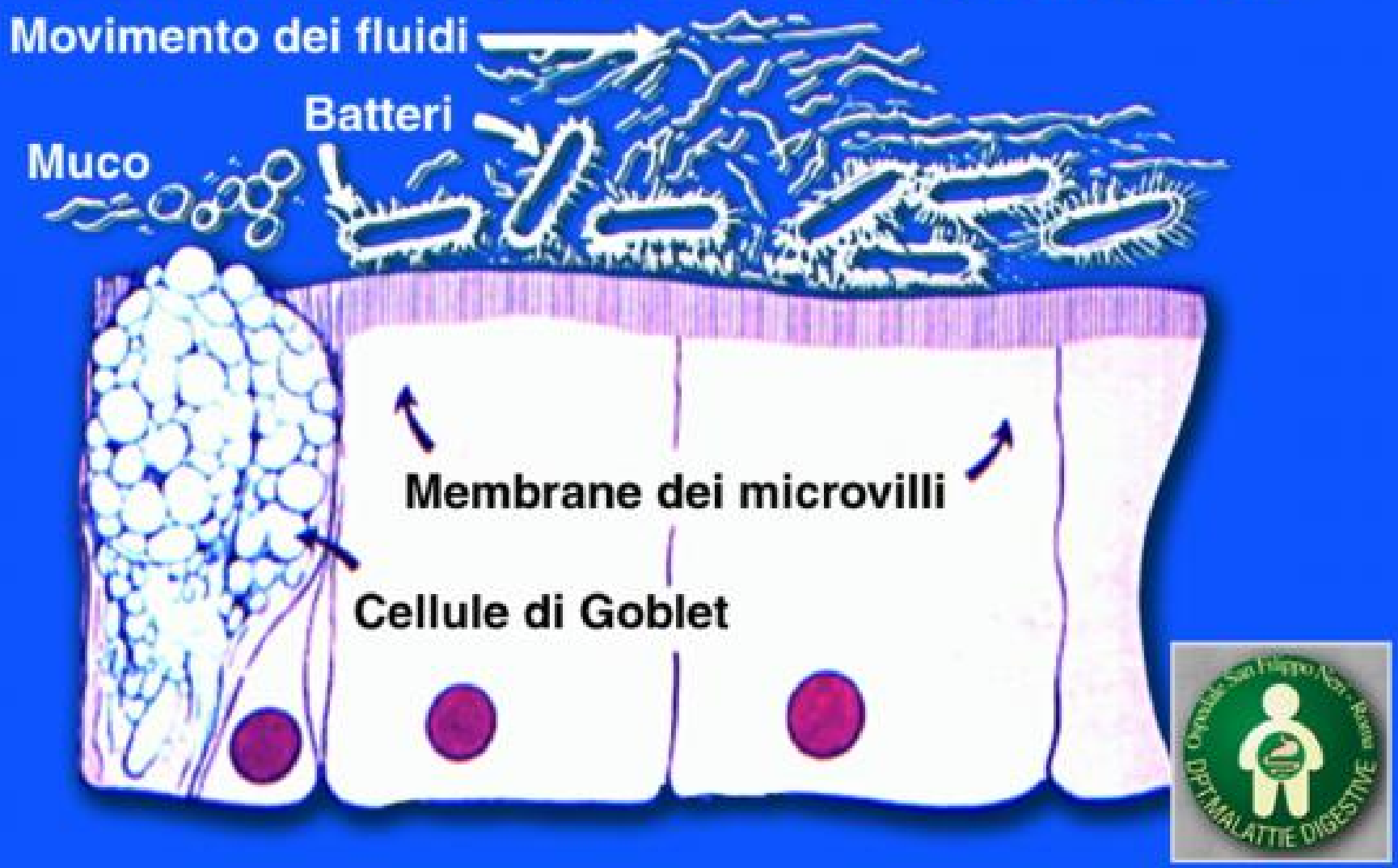
Prevenzione di aderenza dei patogeni & rafforzamento della barriera mucosa intestinale

Produzione di sostanze antimicrobiche per rimuovere i patogeni

Aumento della risposta immune dell'ospite



I BATTERI ADERISCONO ALLA SUPERFICIE EPITELIALE



PROBIOTICI

Vi è buona evidenza che ceppi specifici di probiotici siano sicuri per uso umano ed in grado di conferire alcuni effetti benefici all'ospite, ma questi benefici non possono essere estrapolati ad altri ceppi senza specifica sperimentazione.

A,b,c di microbiologia

- **Singolo Batterio** **ceppo**
- **Ceppi simili** **specie**
- **Specie simili** **genere**
- **Ceppi diversi** **proprietà diverse**

- **Specie batteriche diverse colonizzano specie animali diverse**
- **Ogni ceppo deve essere registrato in una batterioteca riconosciuta.**

Stessa specie, differenti funzioni



Cane da slitta
- **resiste al freddo**
- **resiste alla fatica**
- **buone zampe**



Cane da guardia
- **protettivo**
- **muscolare**
- **denti forti**
- **aspetto feroce**
- **coraggioso**



Cane da caccia
- **buon odorato**
- **buon nuotatore**

Non tutti i cani sono adatti a tutti i compiti

Ospedale San Filippo Neri - Roma
DIPT. MALATTIE DIGESTIVE

Probiotici per Uso Umano

Lactobacillus species

- *L. acidophilus*
- *L. paracasei* F19
- *L. crispatus*
- *L. gasseri*
- *L. johnsoni* La1
- *L. reuteri*
- *L. rhamnosus* GG
- *L.salivarus*(UCC18)

Bifidobacterium species

- *B. adolescent.*
- *B. animalis*
- *B. bifidum*
- *B. longum*
- *B. infantis*
- *B. lactis* (Bb12)

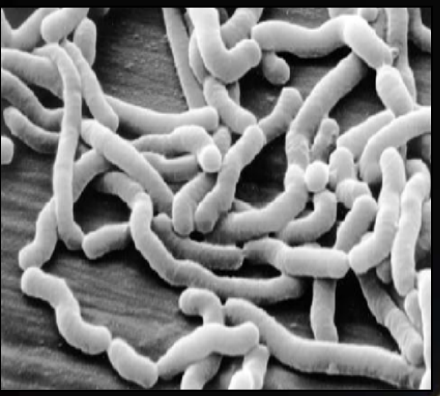
Altri batteri

- *E.faecalis*
- *E faecium*
- *L. lactis*

Microorganismi non Producenti Ac latt

- *B. cereus*
- *B. subtilis*
- *S. cerevisiae*
- *S. boulardi*

Probiotic Strain Characteristics



Human origin

Acid and bile stability

Adherence to human intestinal cells

Colonization of the human intestinal tract

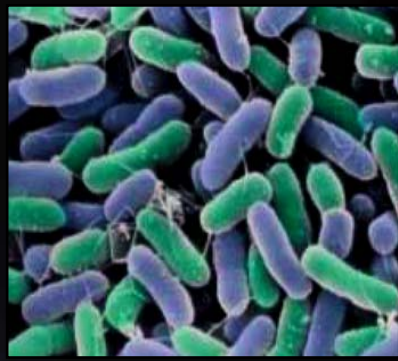
Production of antimicrobial substances

Antagonism against cariogenic and pathogenic bacteria

Safety in food and clinical use

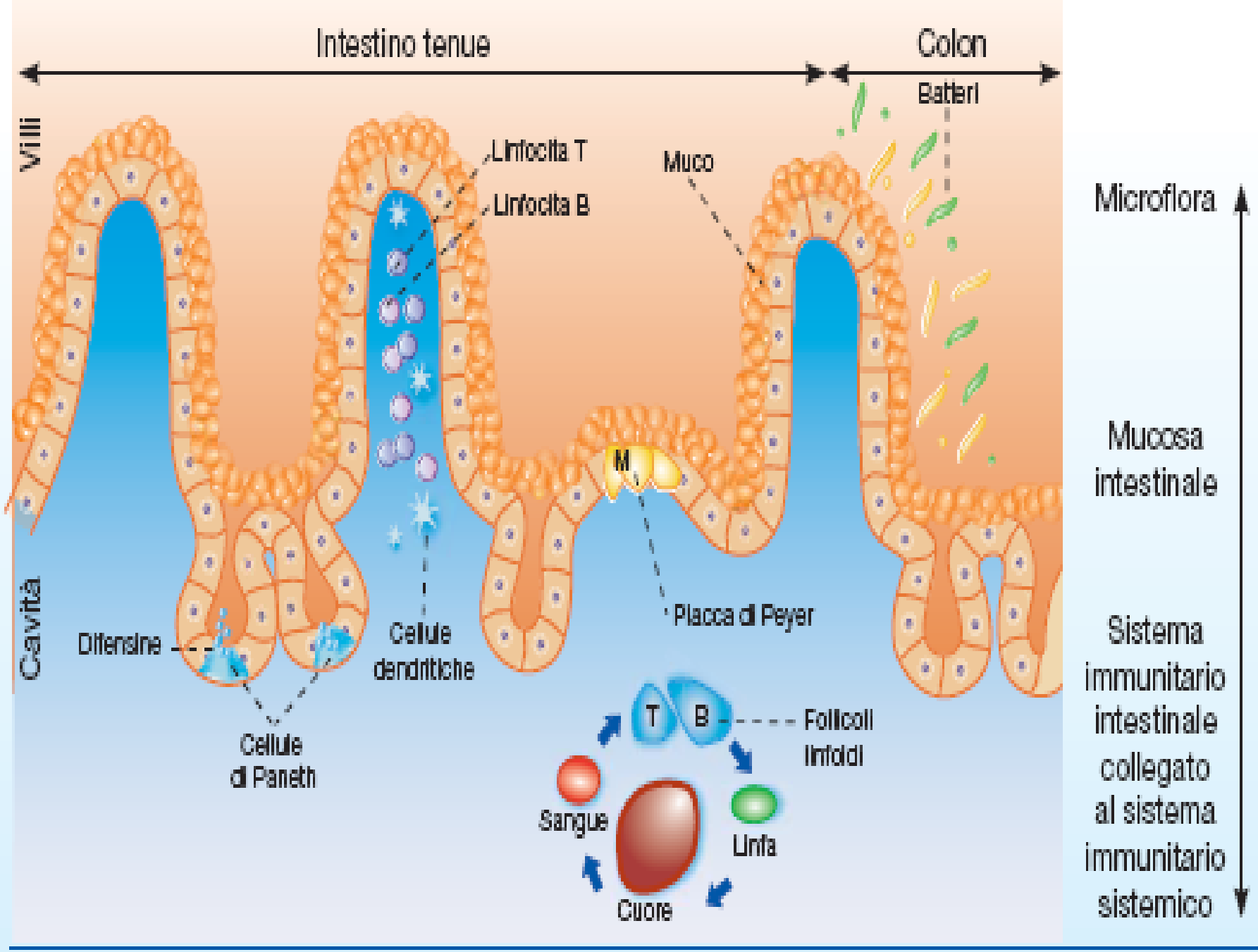
Clinically validated and documented health effects

Shelf life and stability during processing and storage



PROBIOTICI & BARRIERA MUCOSA

- **Miglioramento della barriera mucosa**
- **Stabilizzazione della microflora**
- **Normalizzazione della permeabilità mucosa**
- **Diminuizione dell'adesione dei patogeni**
- ***Up-* o *down-regulation* della immunità intestinale**
- **Miglioramento della salute dell'ospite**


Intestino tenue
Colon
Batteri
Villi
Linfocita T
Linfocita B
Muco
Microflora
M
Mucosa intestinale
Cavità
Difensine
Cellule dendritiche
Placca di Peyer
Cellule di Paneth
T
B
Follicoli linfoidi
Sangue
Linfa
Cuore
Sistema immunitario intestinale collegato al sistema immunitario sistemico

The gut

An important source of antigenic stimulation in frail elderly

APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Oct. 2005, p. 6438–6442 Vol. 71

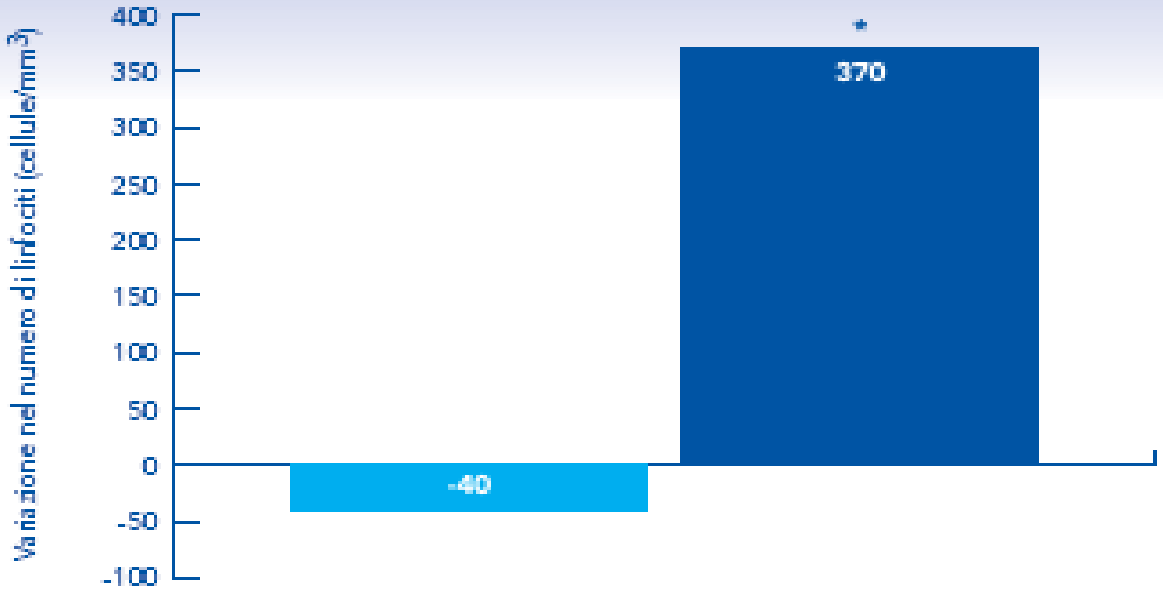
Fecal Microbiota Composition and Frailty

Sandra P. van Tongeren,[1] Joris P. J. Slaets,[2] H. J. M. Harmsen,[1] and Gjalt W. Welling[1]*

Department of Medical Microbiology[1] and Department of Geriatrics,[2] University Medical Center Groningen, Hanzeplein 1, 9713 GZ Groningen, The Netherlands

Received 17 February 2005/Accepted 2 June 2005

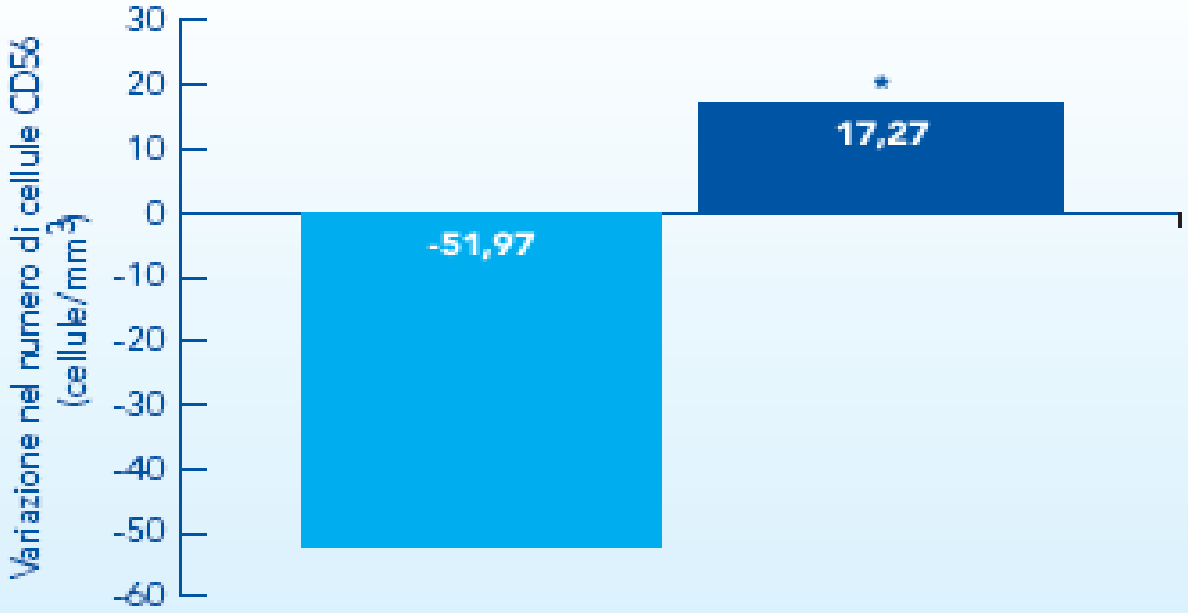
The relationship between fecal microbiota composition and frailty in the elderly was studied. Fecal samples from volunteers with high frailty scores showed a significant reduction in the number of lactobacilli (26-fold). At much higher population levels, both the *Bacteroides/Prevotella* (threefold) and the *Faecalibacterium prausnitzii* (fourfold) groups showed a significant reduction in percentage of total number of hybridizable bacteria in the elderly with high frailty scores. In contrast to this, the number of *Enterobacteriaceae* was significantly higher (sevenfold) in samples from very frail volunteers.



Variazione nel conteggio differenziale dei globuli bianchi (Marcoe et al. 2004)

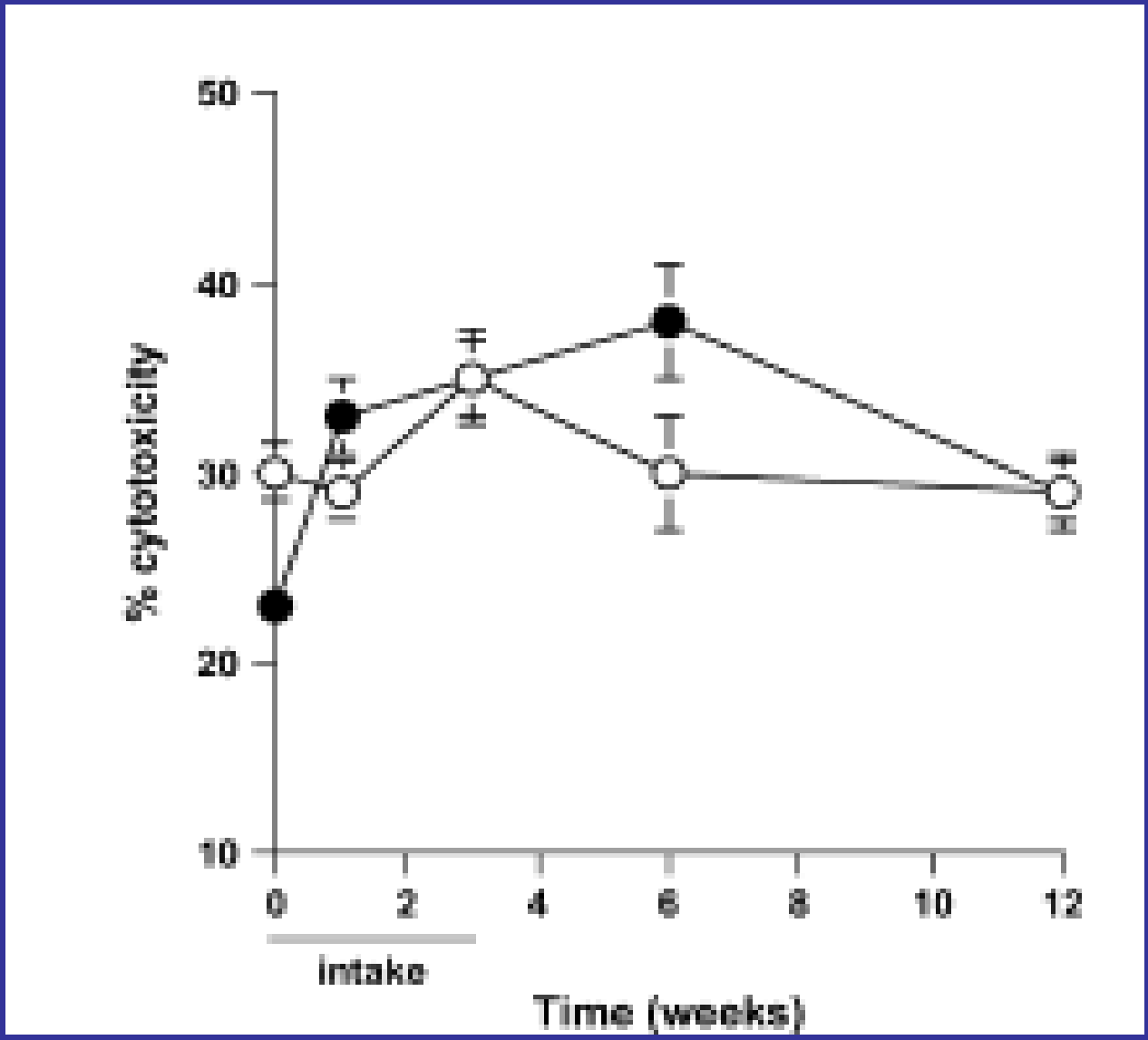
***L. casei* IMUNITASS**

Gruppo di controllo

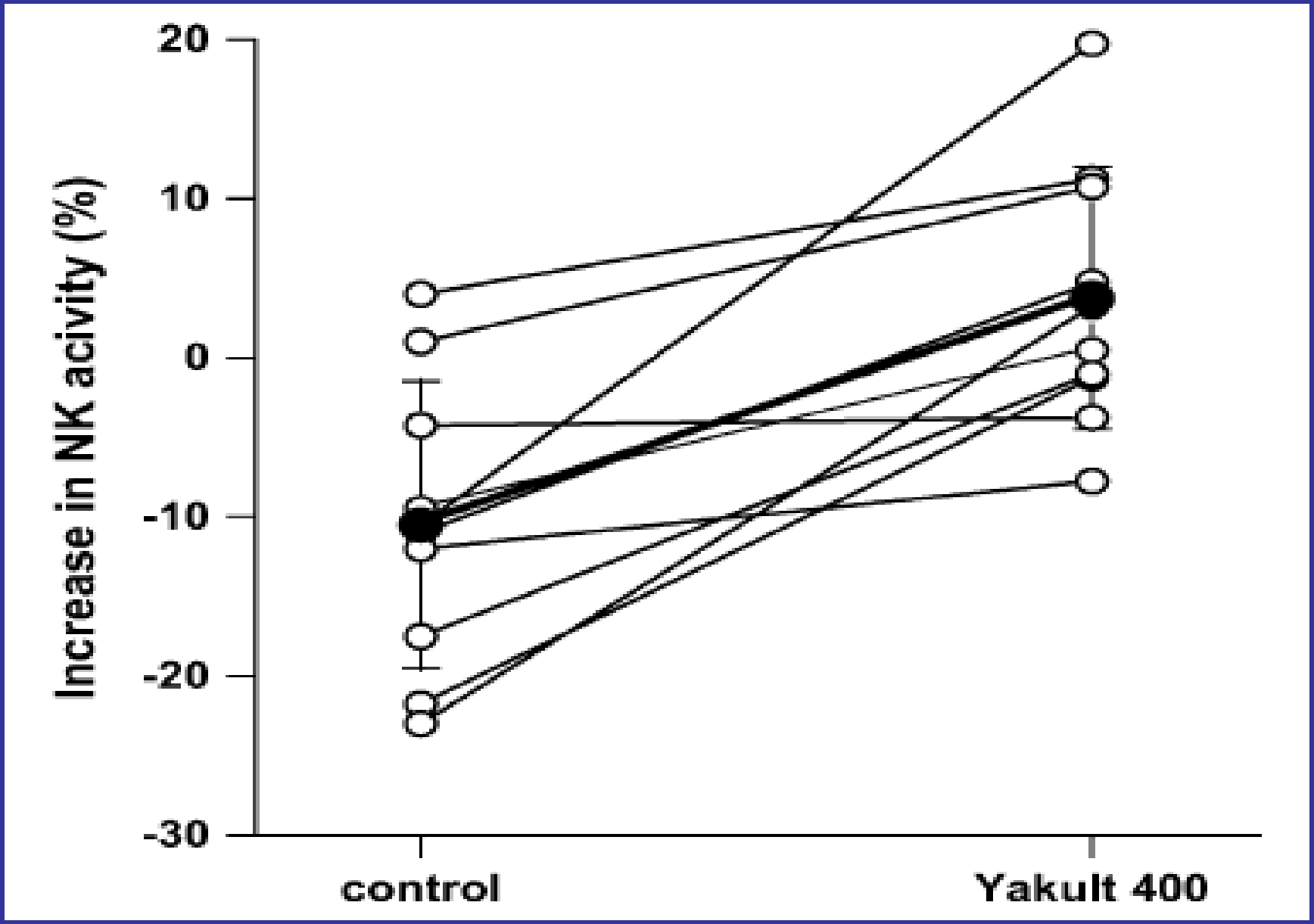


Variazione nel conteggio assoluto dei sottogruppi di linfociti (Marcoe et al. 2004)

* p<0,05



Change in NK-cell activity. Each of the volunteers drank a bottle of Yakult 400 (d) containing Lactobacillus Casei Shirota or unfermented (s) milk daily for 3 weeks.
(J. Nutr. 137: 791S–793S, 2007)



NK-cell activity in elderly subjects (J. Nutr. 137: 791S–793S, 2007)

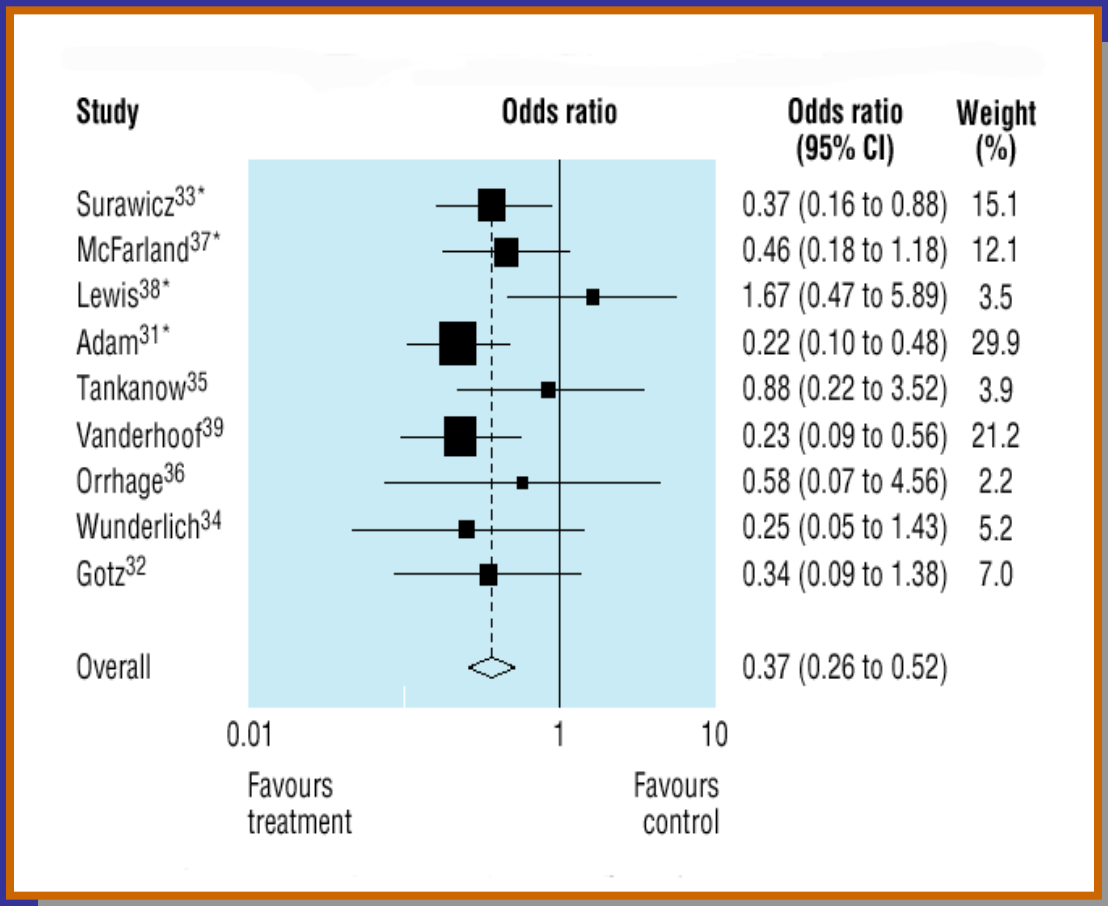
Probiotici nella Prevenzione della Diarrea da Antibiotici: una Metanalisi

Probiotici impiegati nei Trials

S. boulardi
L. acidophilus + L. bugaricus
S. boulardi
E. faecium SF68
L. acidophilus + L. bugaricus
L. acidophilus + Bifidobacterium longum
S. boulardi
S. boulardi
Lactobacillus GG

Pazienti Inclusi nei Trials

Solo Adulti



[D'Souza et al., BMJ 2002; 324: 1361-1366]

Probiotici nella Prevenzione della Diarrea da Antibiotici: una Metanalisi

Probiotici impiegati nei Trials

S. boulardi

S. boulardi

Lactobacillus spp

Lactobacillus spp

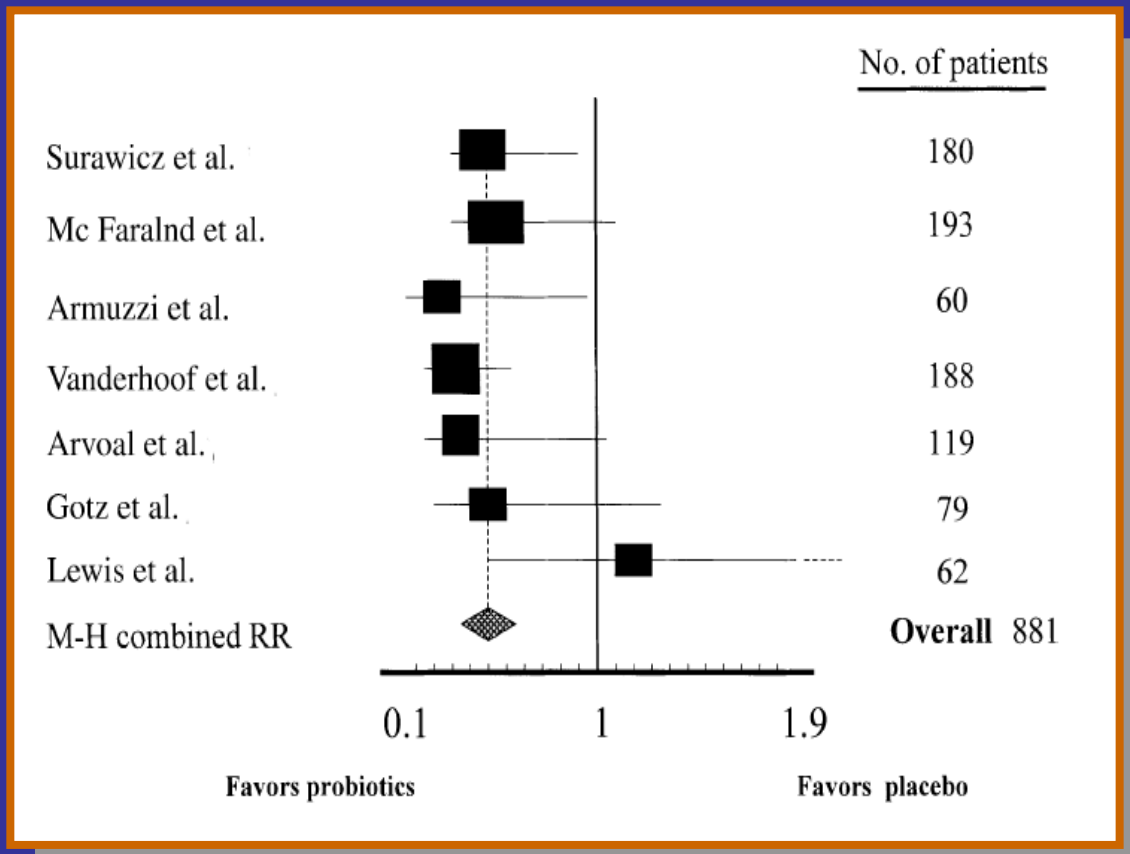
Lactobacillus spp

Lactobacillus spp

S. boulardi

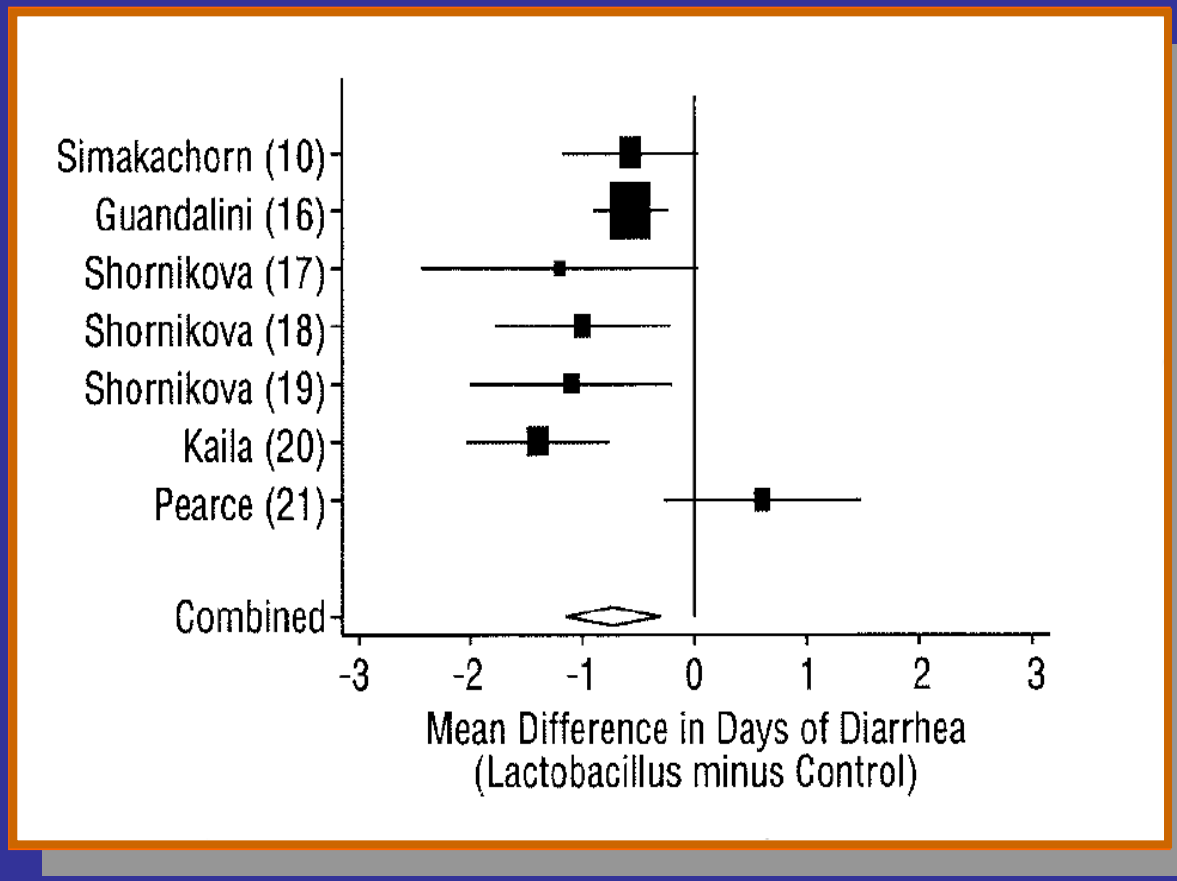
Patienti Inclusi nei Trials

Adulti e Bambini



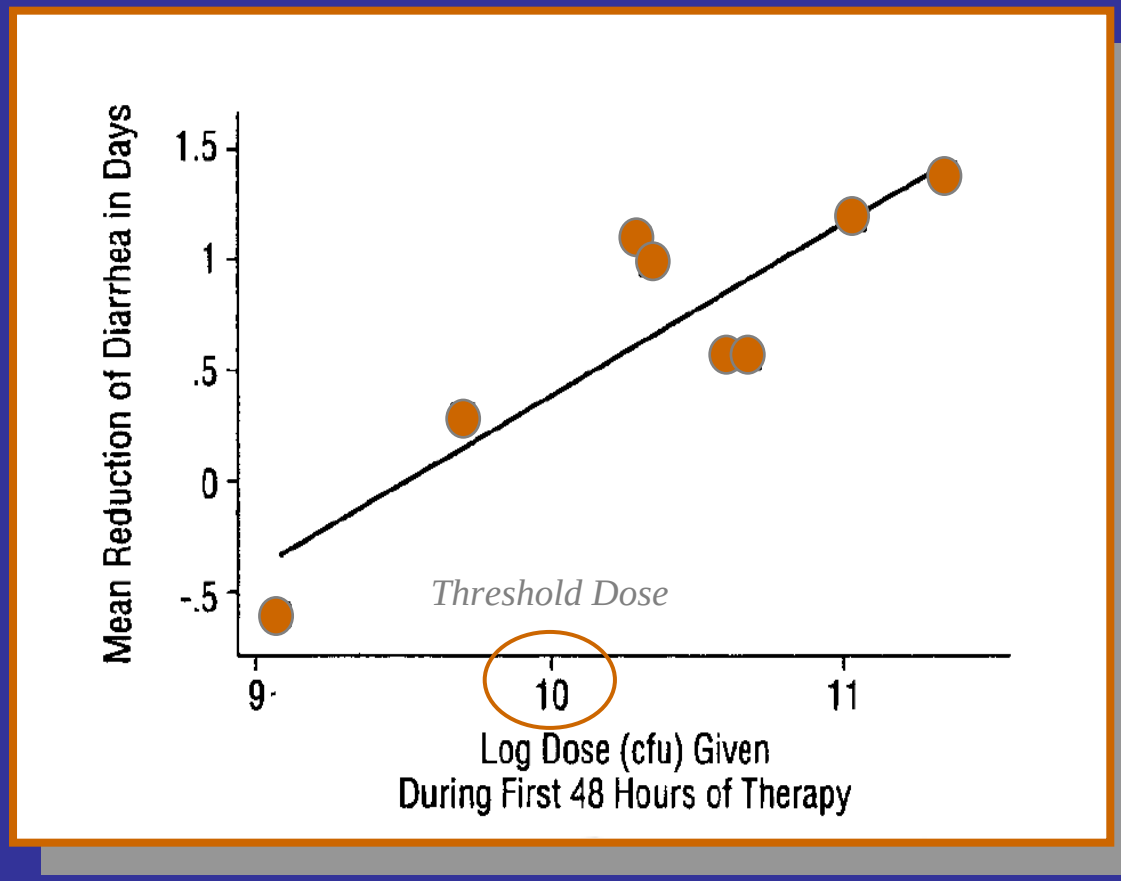
[Cremonini et al., APT 2002; 16: 1461-1467]

Terapia con *Lactobacillus* per la Diarrea Acuta Infettiva nei Bambini: Una Metanalisi



[Van Niel et al., Pediatrics 2002; 109: 678-684]

Terapia con *Lactobacillus* per la Diarrea Acuta Infettiva nei Bambini: Rapporto Dose-effetto



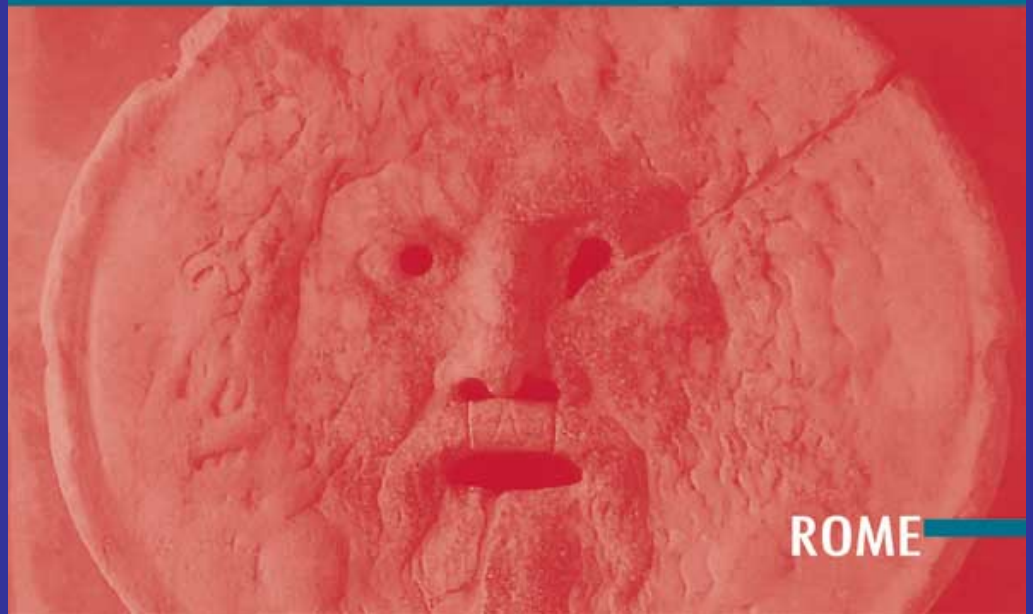
[Van Niel et al., Pediatrics 2002; 109: 678-684]



September, 2007

4th PROBIOTICS & PREBIOTICS

NEW FOODS



ROME

FAO Technical Meeting on Prebiotics.



September 15-16, 2007.

Rome, Italy.

Prebiotics: Definition

“Food component that confer a health benefit on the host through modulation of the microbiota”

FAO Technical Meeting, 2007

PREBIOTICI

Carboidrati non digeribili (NDO= non-digestible oligosaccharides) che raggiungono il colon dove :

1. Nutrono i batteri
2. Stimolano l'accrecimento di batteri

PREBIOTICS or NON-DIGESTIBLE OLIGOSACCHARIDES (NDO)

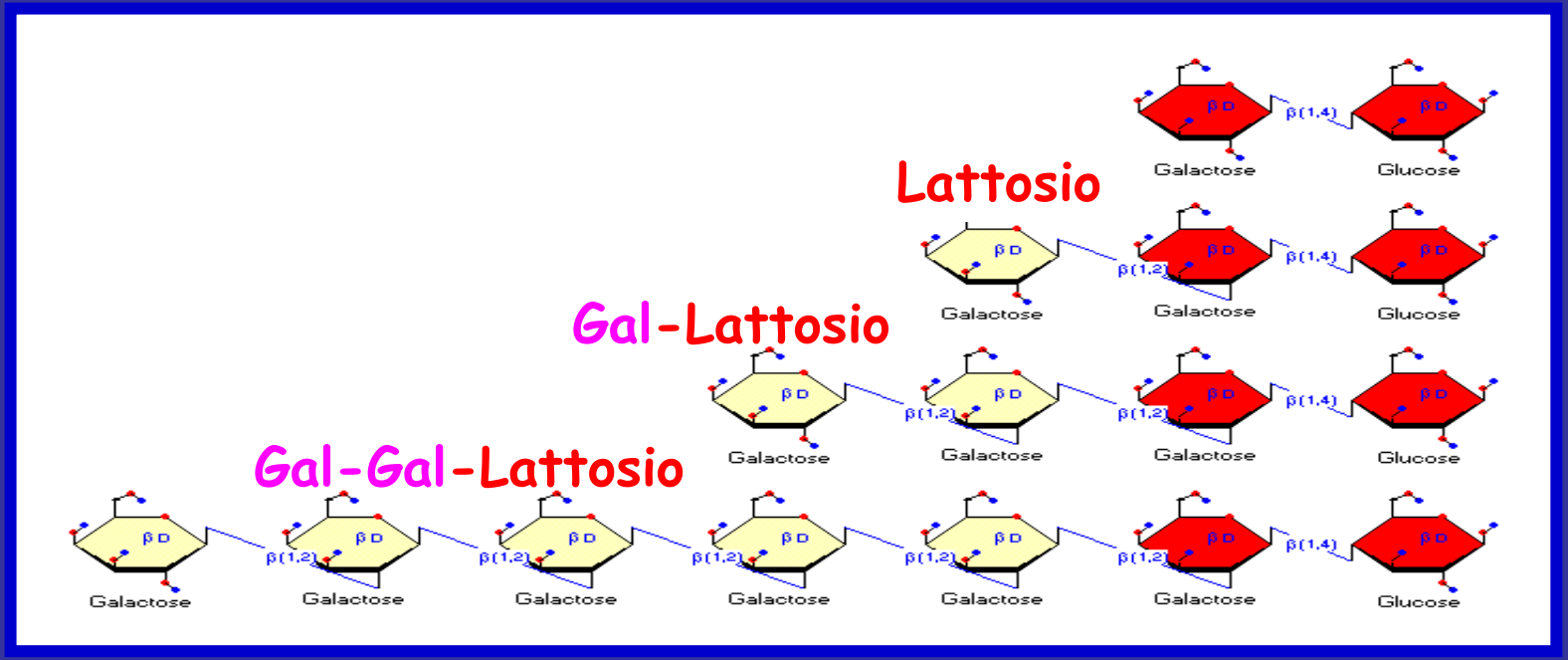
1. Xylo-oligosaccharides
2. Soybean oligosaccharides
3. Transgalactosylated oligosaccharides (GOS)
4. Palatinose condensates
5. Isomalto- oligosaccharides
6. Inulin
7. Oligofructose (FOS)
8. Pyrodextrin

CARATTERISTICHE DEI PREBIOTICI

- Non idrolisi o assorbimento nel tratto g-i alto
- Substrato selettivo per batteri del colon potenzialmente benefici
- Modificazione del microbiota colico
- Induzione di effetti luminali o sistemici benefici

(Gibson GR. *J. Nutr*. :1995; 125:1401-12)

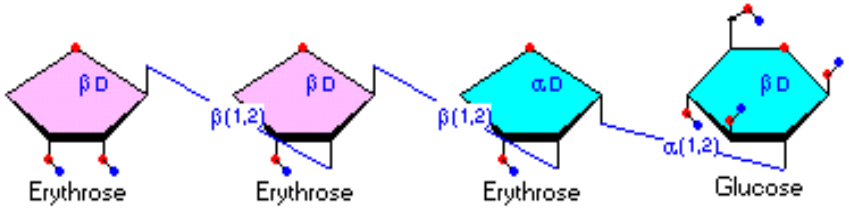
Galatto-oligosaccaridi (GOS)



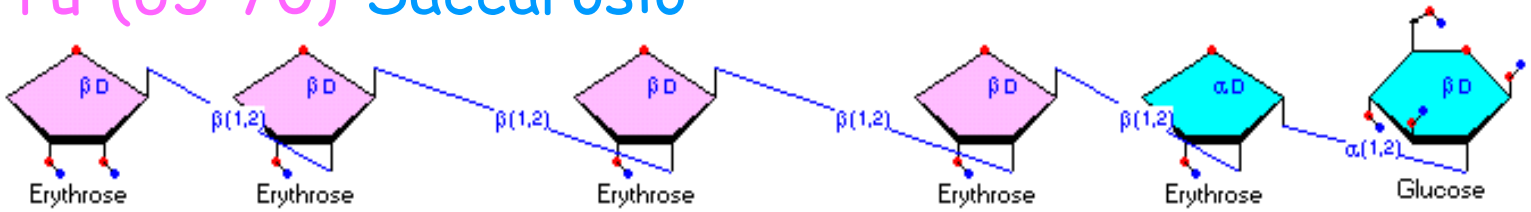
Inulina

Fru-Saccarosio

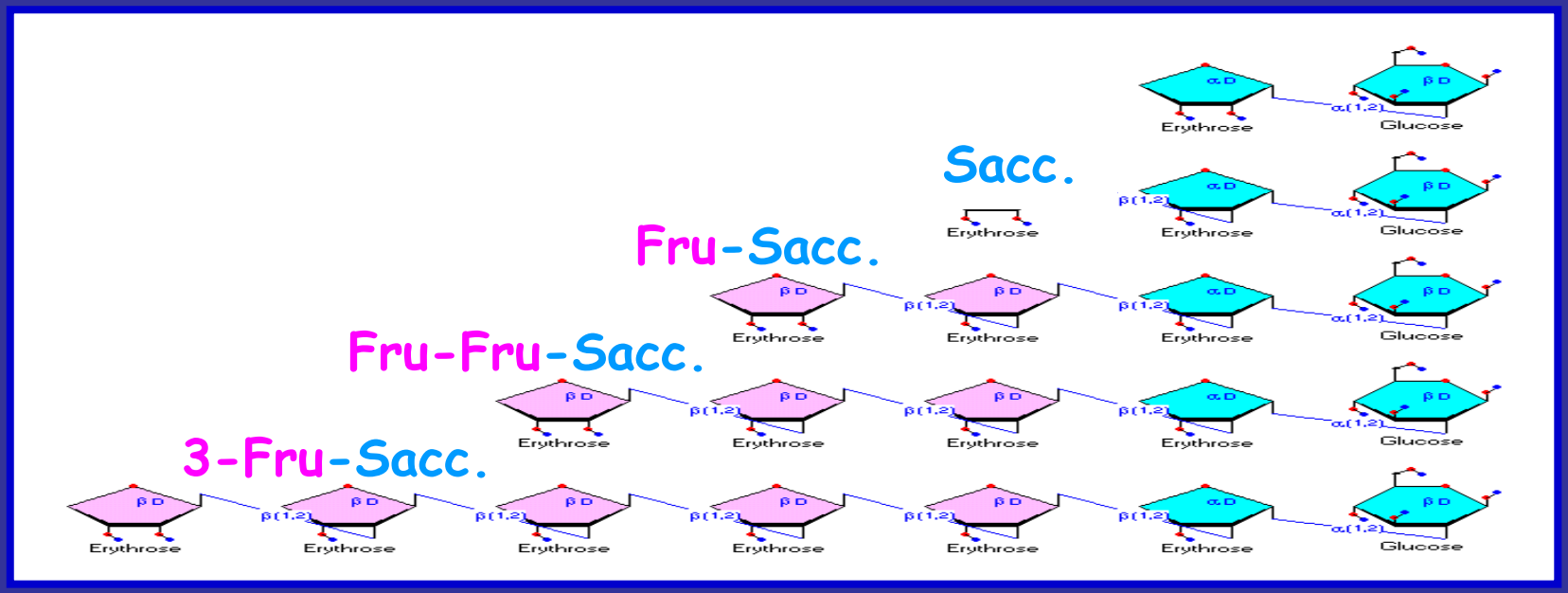




Fru-(65-70)-Saccarosio



Frutto-oligosaccaridi (FOS)



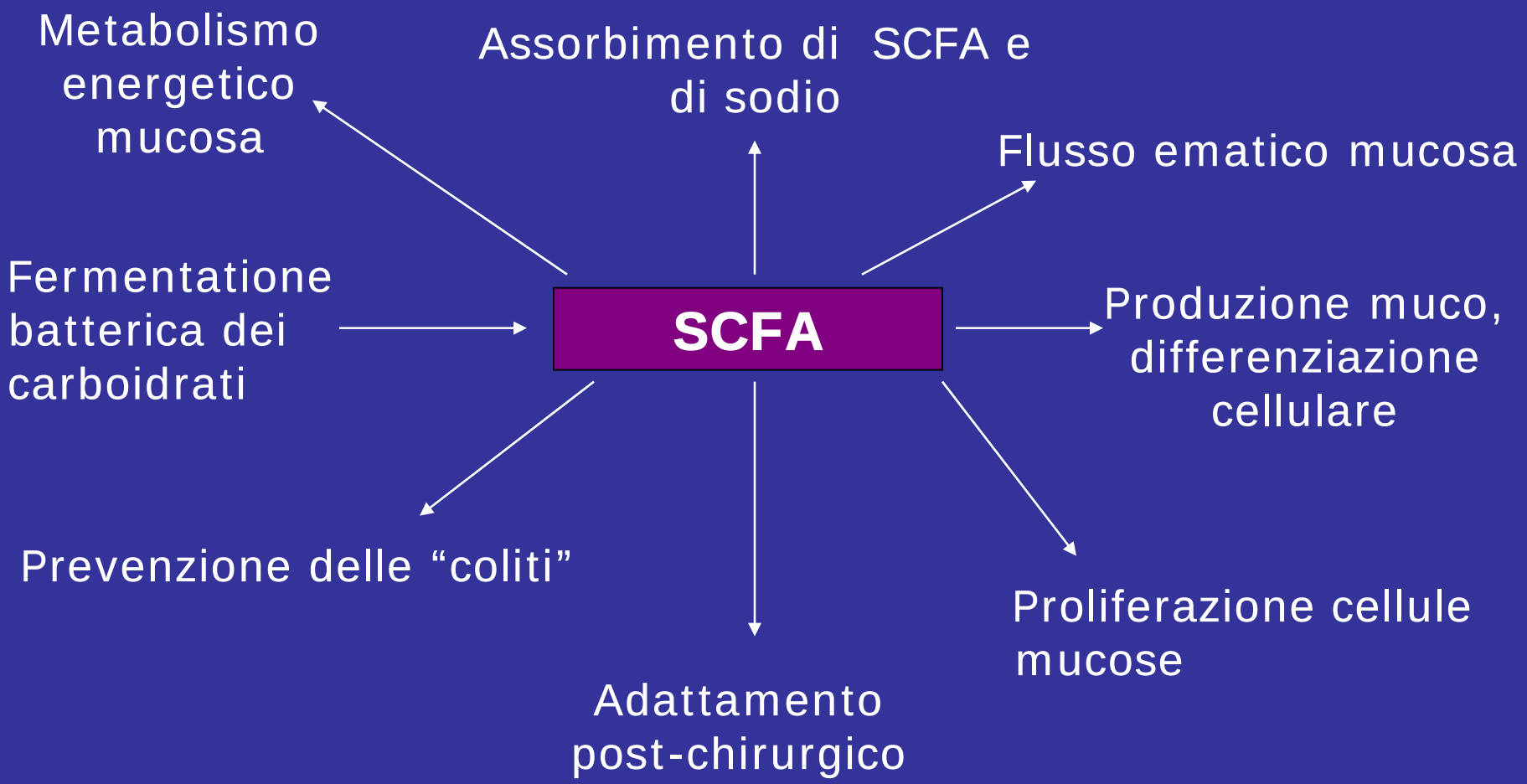
Produzione di SCFA

La flora anaerobica del colon converte i carbo-idrati a SCFA (ac.grassi a catena corta)

In vitro

- **Inulina → acetato & butirato**
- **GOS → acetato & propionato**
- **XOS → solo acetato**

SCFA


Metabolismo energetico mucosa
Assorbimento di SCFA e di sodio
Flusso ematico mucosa
Fermentatione batterica dei carboidrati
SCFA
Produzione muco, differenziazione cellulare
Prevenzione delle “coliti”
Proliferazione cellule mucose
Adattamento post-chirurgico

Interazioni nel tratto gastrointestinale fra probiotici,prebiotici & flora intestinale

