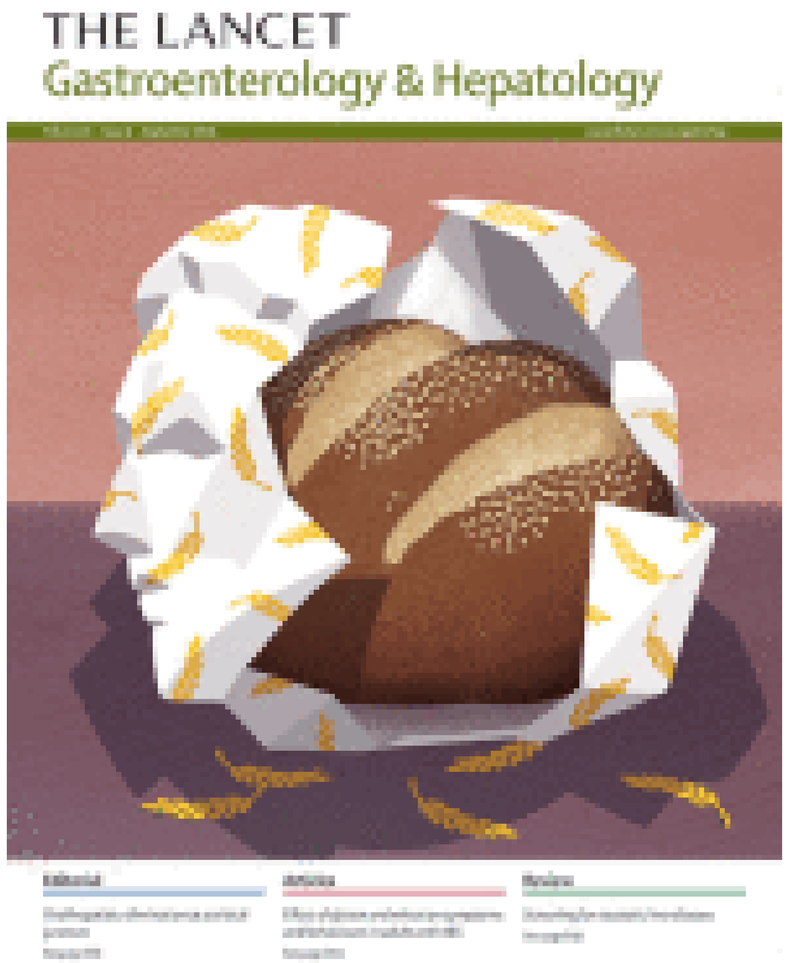
THE LANCET
Gastroenterology & Hepatology

TECNOPOLO
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SCIENZA E SALUTE – IL RUOLO DEL CIBO NELLA NOSTRA VITA QUOTIDIANA

Prof. Carlo Fabbri
Dott.ssa Elisa Liverani
U.O.C. Gastroenterologia ed Endoscopia digestiva Forlì-Cesena

COESIONE ITALIA 21-27 EMILIA-ROMAGNA
Cofinanziato dall'Unione europea
REPUBBLICA ITALIANA
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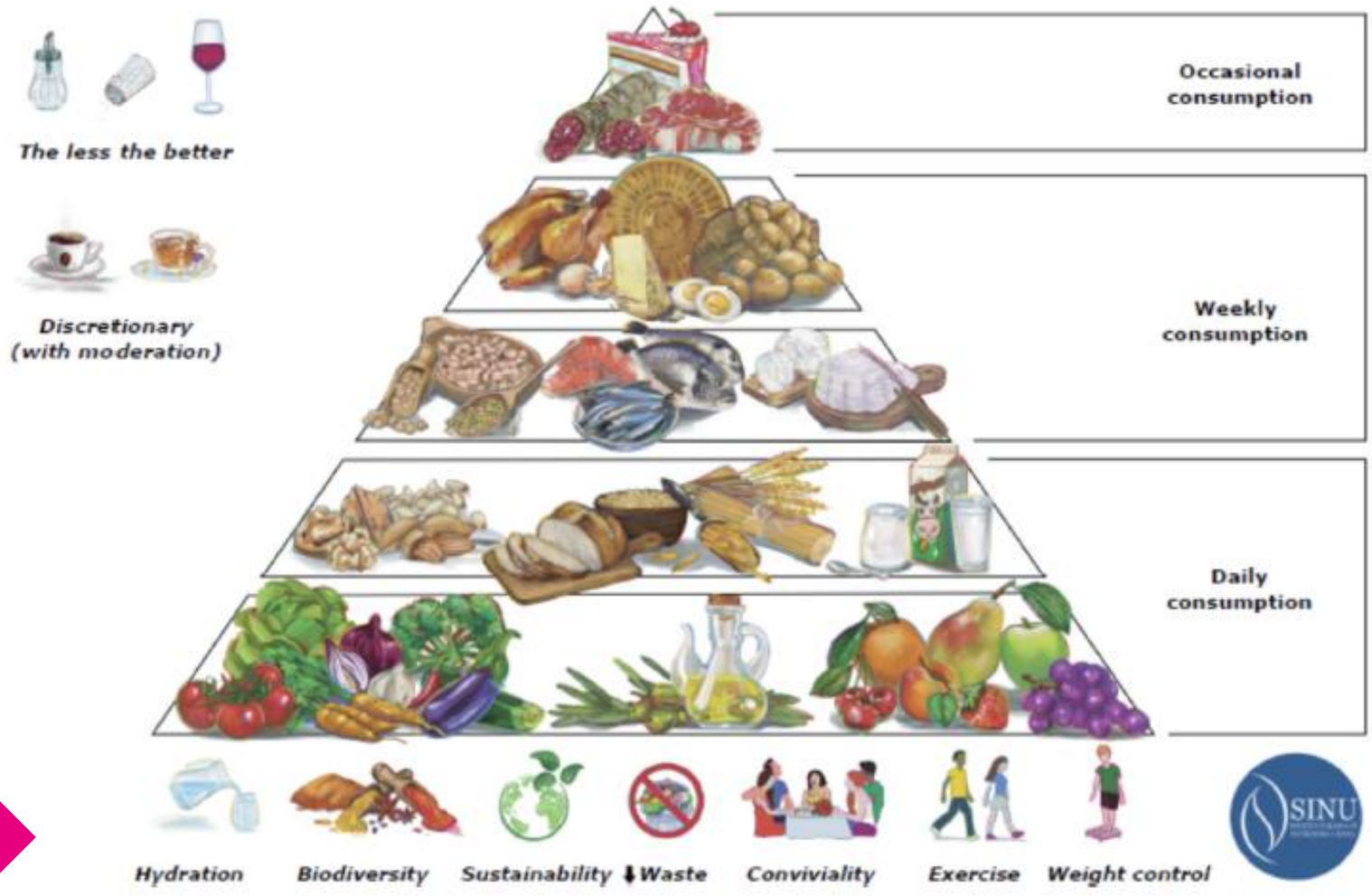
YOU ARE WHAT YOU EAT:

Diet - Health

Il Mangiafagioli, Annibale Carracci, 1584-1585

MEDITERRANEAN DIET



UNESCO 2010: Patrimonio Culturale Immateriale dell'Umanità

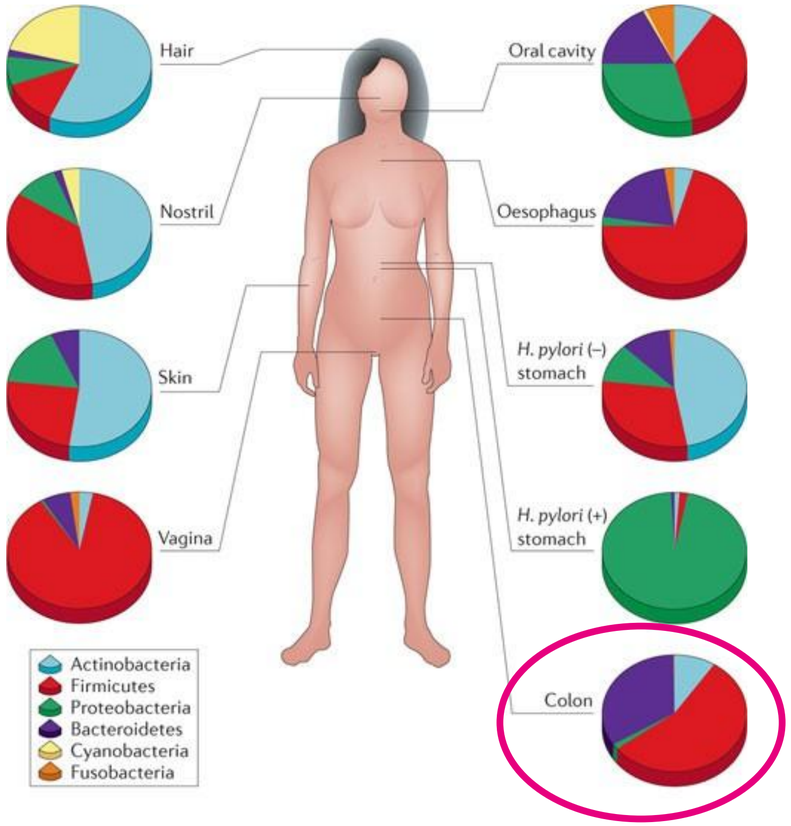
Sofi F et al, Nutrition, metabolism and cariovascular disease, 2025

FAO and WHO. Sustainable healthy diets – guiding principles. Rome 2019.

YOU ARE WHAT YOU EAT:

Diet, Health….
…and the gut microbiota

THE HUMAN MICROBIOME



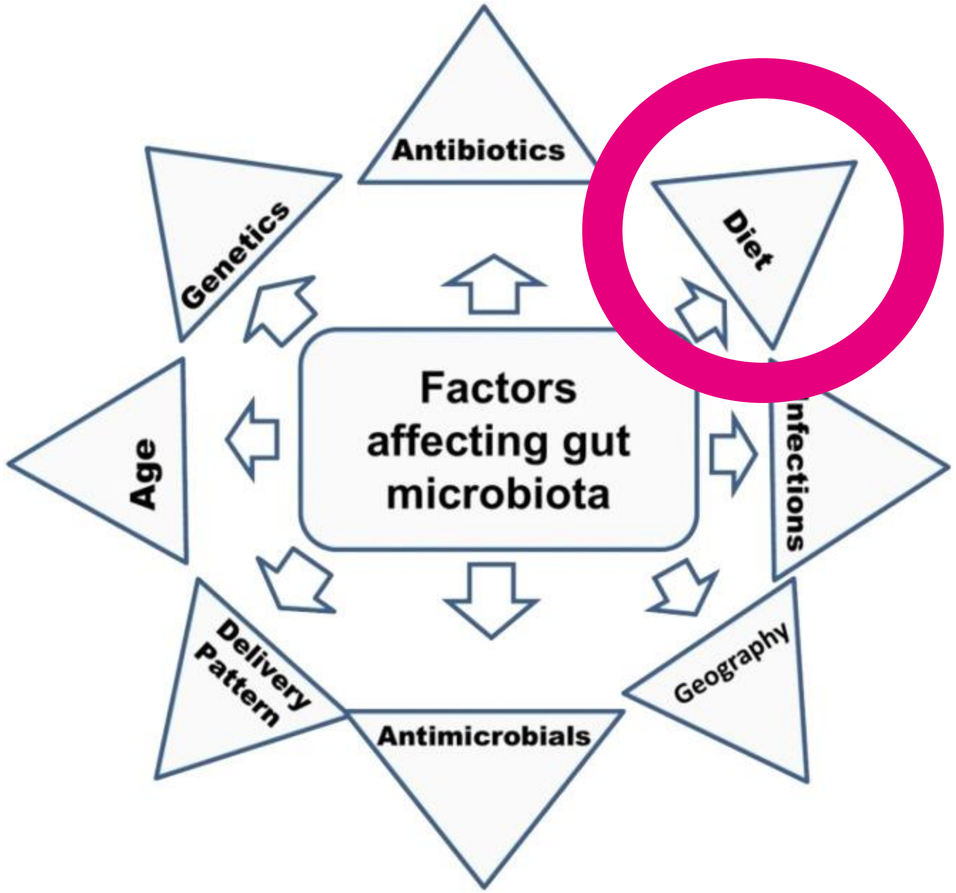
Human Gut Microbiota Composition

MAJOR PHYLA		SPECIES
90%	*Firmicutes*	• *Ruminicoccus* • *Faecalibacterium* • *Claostridium* • *Roseburia* • *Lactobacillus* • *Streptococcus* • *Eubacterium*
	Bacteroidetes	• *Bacteroides* • *Prevotella* • *Xylanibacte*
10%	*Proteobacteria*	• *Escherichia* • *Desulfovibrio*
	Actinobacteria	• *Collinsella* • *Bifidobacterium*
	Euryarchaeota	• *Methanobrevibacter*
	Verrucomicrobia	• *Akkermansia*

Cho I and Blaser MJ. Nat Rev Genet 2012
B. Madhogaria et al, Infectious Medicine, 2022

Microbial genome is the variable part of our genome that makes possible human adaptation to external perturbations *(ie diet, starvation, overfeeding, food preservatives, antibiotics, stress, violence..)*

Microbiota INFLUENCERS

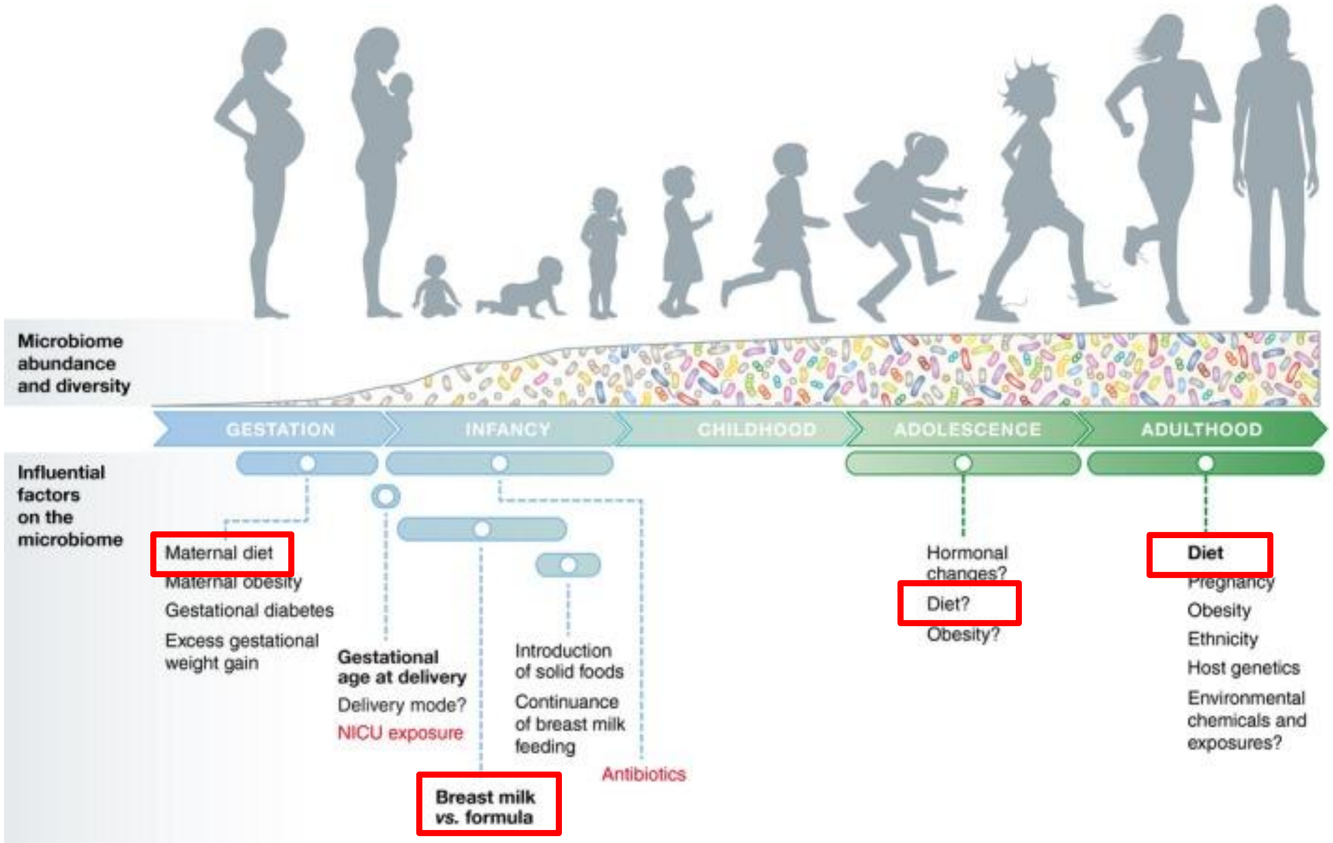


DIET

- Composition (calories, fat, vegetable, meat..)
- Cooking
- Natural food additives (safrolo..)
- Artificial chemical food additives:
    - Preservatives (benzoic acid, sodium benzoate, nitrite/nitrate, sulfur dioxide/sulfite..)
    - Sweeteners, emulsifiers and stabilizers, flavors, thickeners, antifoaming, anticaking, bulking, antioxidants..)
    - Others (titanium dioxide..)

B. Madhogaria et al, Infectious Medicine, 2022

OUR MICROBIOME VARIES OVER TIME

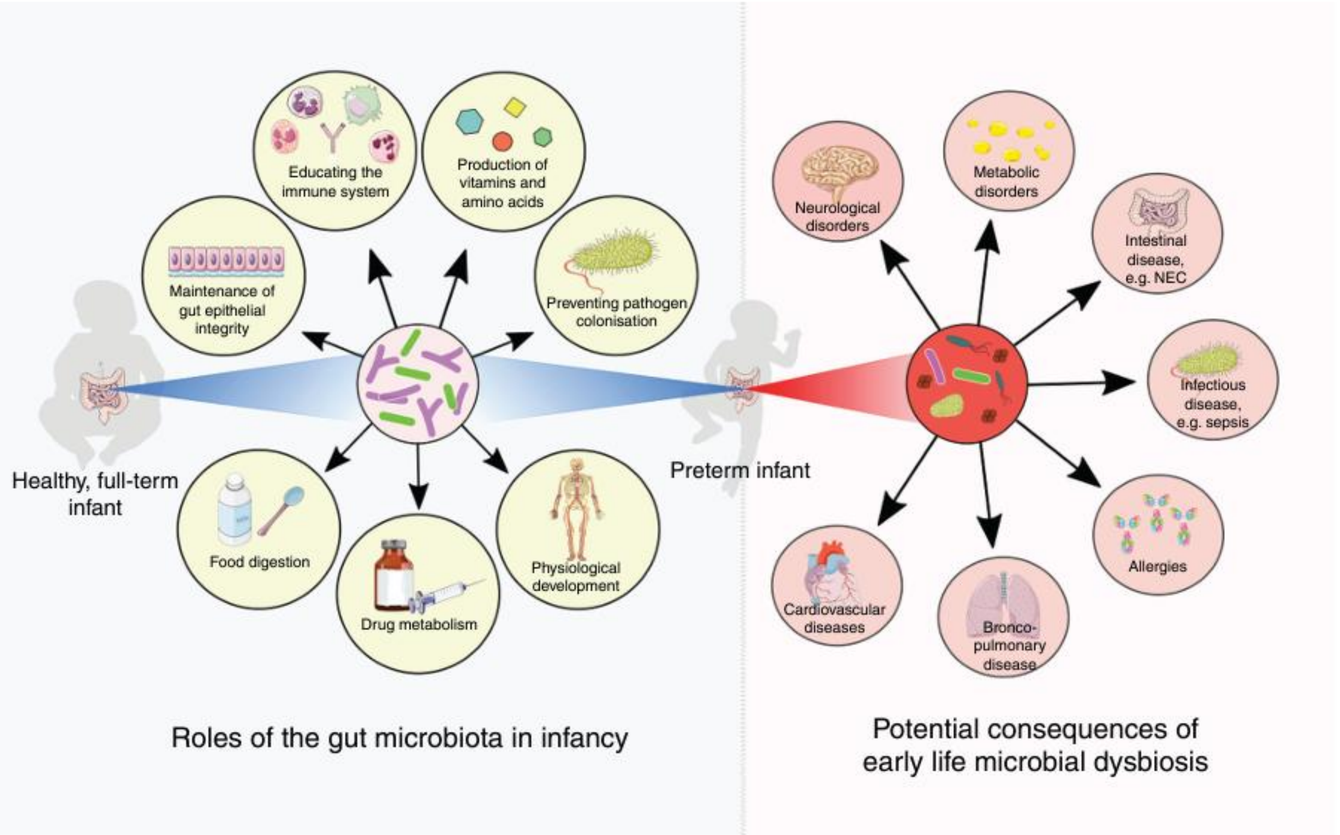


Aagaard K et al., EMBO, 2016

DYSBIOSIS IN A CRITICAL TIME WINDOW HAS LONG LASTING CONSEQUENCES

Transient early microbiota dysbiosis (e.g. perturbation by antibiotic use or C-section delivery)

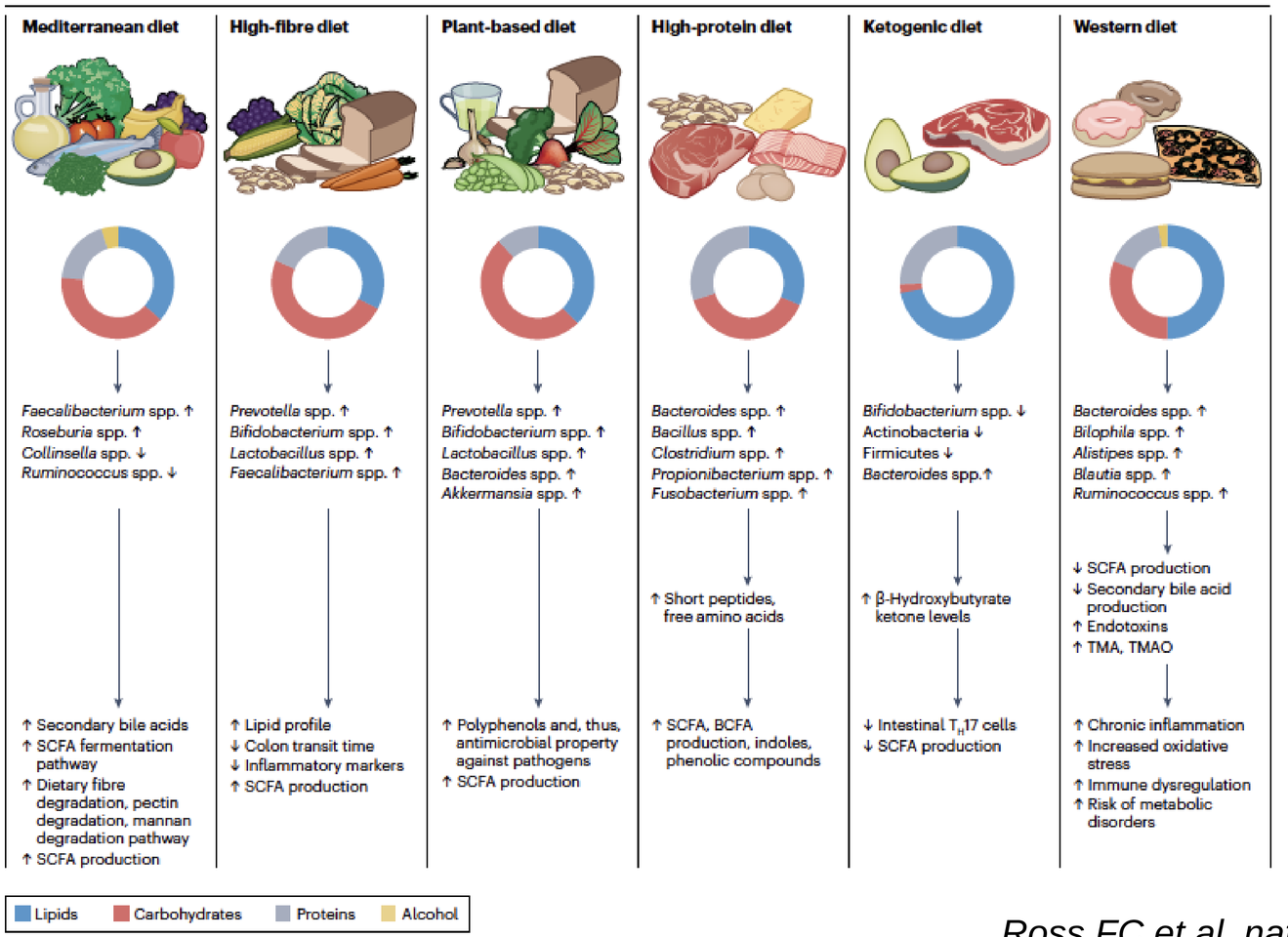
Long-term metabolic and immunological consequences (overweight/obesity, allergy, asthma, atopy, diabetes, IBD, neurological disorders, etc)



Ahearn-Ford S, et al. Exp Physiol. 2022 May;107(5):415-421.

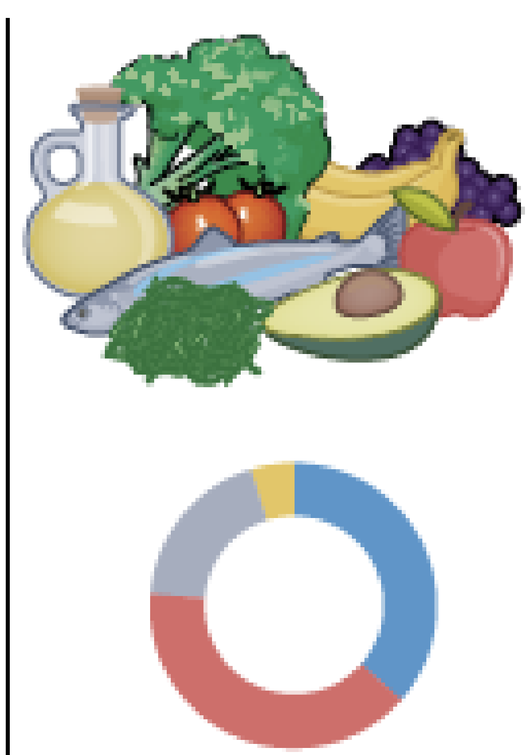
THE RIGHT DIET FOR THE RIGHT MICROBIOME

DIETARY FIBRES !!!



Ross FC et al, nature reviews microbiology, 2024

THE RIGHT DIET FOR THE RIGHT MICROBIOME: Mediterranean Diet

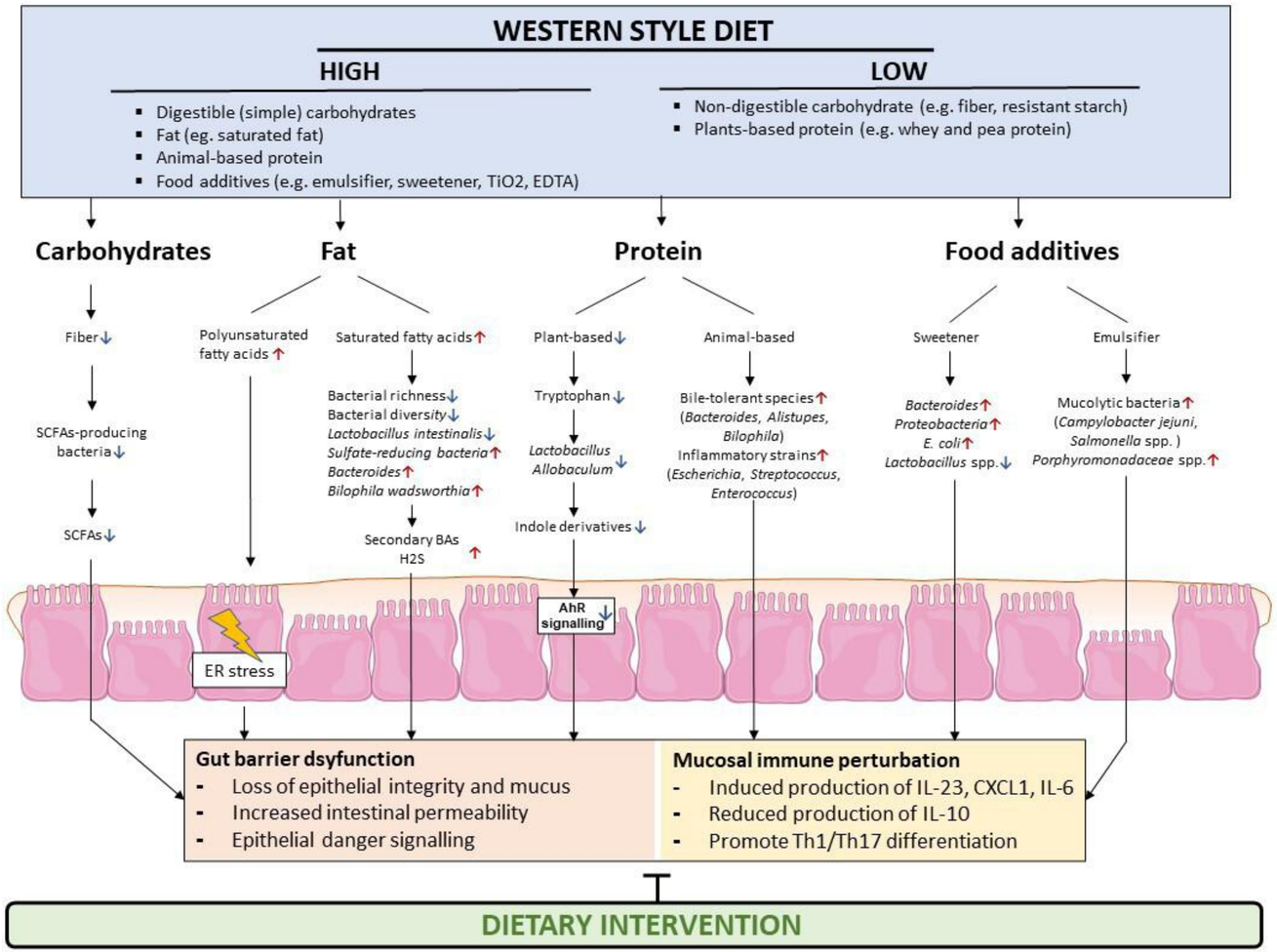


Faecalibacterium spp. ↑
Roseburia spp. ↑
Collinsella spp. ↓
Ruminococcus spp. ↓

↑ Secondary bile acids
↑ SCFA fermentation pathway
↑ Dietary fibre degradation, pectin degradation, mannan degradation pathway
↑ SCFA production

Ross FC et al, nature reviews microbiology, 2024

Western diet



Dietary constituents such as macronutrients and food additives have been shown to affect the gut microbiota in humans:

1. Loss of production of beneficial microbial metabolites, such as SCFAs and indole derivatives.

2. Epithelial barrier impairment

3. Stimulation of a proinflammatory environment

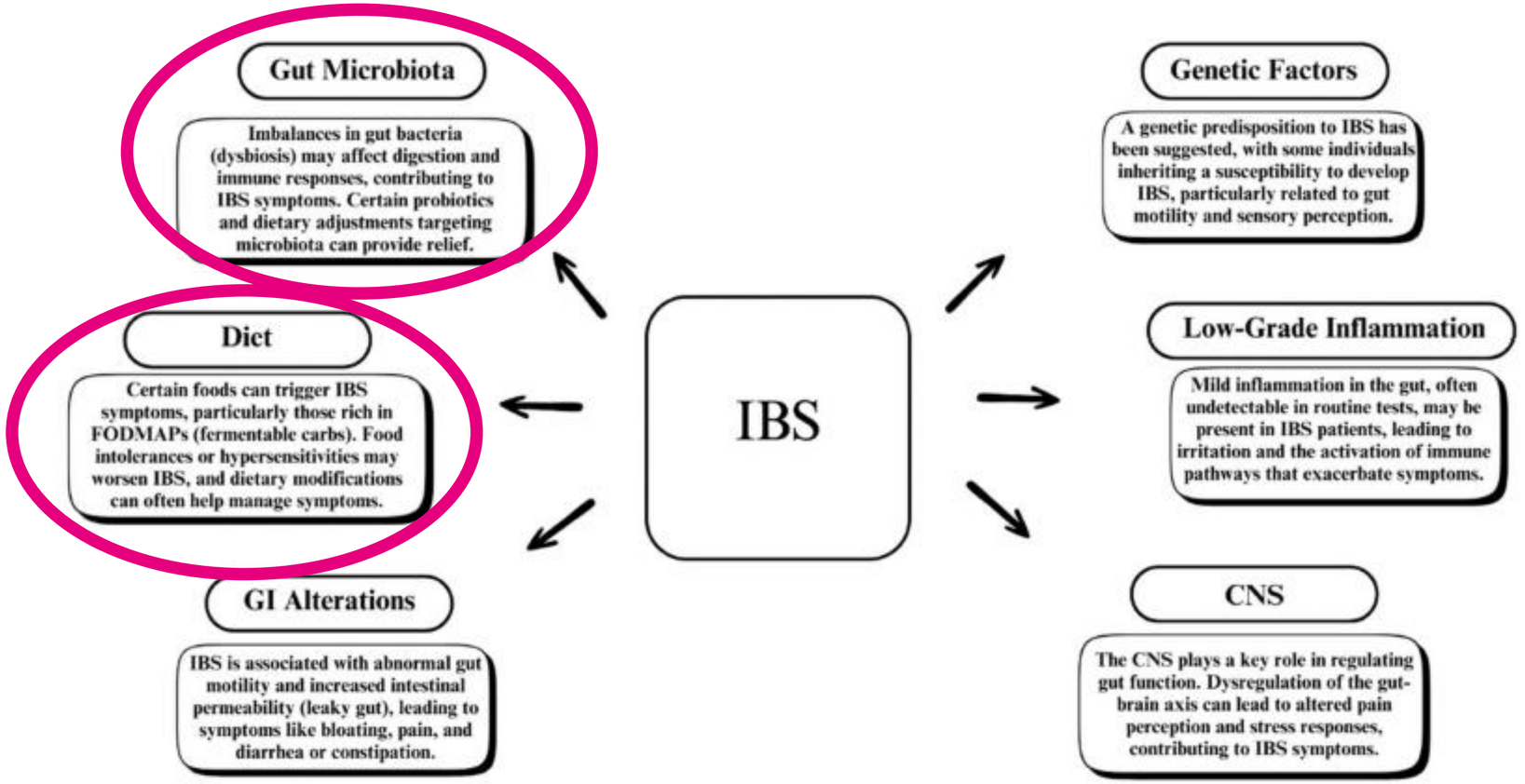
Ross FC et al, nature reviews microbiology, 2024

GUT DYSBIOSIS CHART FOR DIFFERENT DISEASE

Disease	Bacteria that decreases in number	Bacteria that increases in number
Colorectal cancer	↓*Prevotella*, ↓*Ruminococcus* spp., ↓*Pseudobutyrivibrio ruminis*	↑*Acidaminobacter*, ↑*Phascolarctobacterium*, ↑*Citrobacter farmer*,
Colon cancer	↓*F.*prausnitzii,	↑*Akkermansia muciniphila*
Gastric cancer	↓*Eubacterium* rectalie	↑*Clostridium*,, ↑*Fusobacterium*,
Prostate cancer		↑*Lactobacillus* ↑*Firmicutes/Bacteroideted ratio*
Obesity	↓*Bacteridetes* ↓Methanobrevibacter smithii	↑*Enterobacteria*, ↑*Ruminococcus gnavus*
IBD: Chron's disease	↓*Bacteroides*, ↓*Faecalibacterium prausnitzii* ↓*Bifidobacterium adolescentis*	
Ulcerative cholitis	↓*Bifidobacteria*, ↓*Roseburia hominis* ↓*Faecalibacterium prausnitzii*, ↓*Lachnospiraceae*, ↓*Ruminococcaceae*	
Diabetes: Diabetes type1	↓*Lactobacillus*, ↓*Bifidobacterium*, ↓*Blautia coccoides*, ↓*Eubacterium rectal*, ↓*Prevotella*, ↓*Firmicutes*	↑*Clostridium*, ↑*Bacteroides*, ↑*Veillonella*
Diabetes type2	↓*Firmicutes*, ↓*Clostridia*, ↓*Lactobacillus*, ↓*Eubacterium rectale*,	↑*Bacteroids-Prevotella Verses Clostridiacocoides*, ↑*Betaproteo bacteria*, ↑*Bacteroidetes/Firmicutes ratio*
Cardiovascular disease		↑Clostridium, ↑Lactobacillales, ↑*Enterobacteriaceae* spp, ↑Chryseomonas, ↑Helicobacter, ↑Firmicutes, ↑Bacteroides
Liver disease	↓Alistipes, ↓Bilophila, ↓Veillonella, ↓Faecalibacterium, ↓Ruminococcus, ↓*Bifidobacterium*, ↓Prevotella, ↓Coprococcus, ↓Veillonellaceae, ↓Prevotella copri, ↓Faecalibacterium, ↓Haemophilus	↑Claustridum, ↑Bacteroidetes, ↑Betaproteobacteria, ↑Lactobacillus spp., ↑Collinsella, ↑Corynebacterium, ↑Prevotellaceae, ↑Ruminococcaceae, ↑Sarcina, ↑Sutterellaceae, ↑Enterobacteriaceae, ↑Bacteroidaceae
HIV	↓*Clostridia*, ↓*Bacteroidia*, ↓*Lactobacilli*, ↓*Bifidobacteria*	↑*Erysipelotrichaceae*, ↑*Proteobacteria*, ↑*Enterobacteriaceae*, ↑*Candida albicans* ↑*Pseudomonas aeruginosa*
Autism	↓*Firmicutes*, ↓*Actinobacteria*, ↓*Actinobacteria*	↑*Bacteroides vulgates*, ↑*Desulfovibrio*, ↑*Proteobacteia*
Arthritis	↓*Bifidobacteria*, ↓*Bacteroides fragilis*	

B. Madhogaria et al, Infectious Medicine, 2022

IRRITABLE BOWEL SYNDROME (IBS)

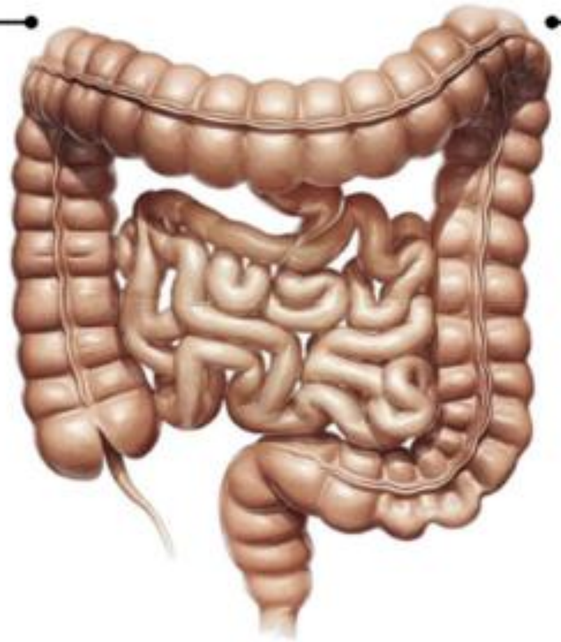


Surdea Blaga et al, 2024

MICROBIOTA ALTERATIONS IN IBS

- *Lactobacillus spp.*
- *Clostridium symbiosum-like*
- *Actinobacteria*
- *Bacteroidetes B. catenulatum*
- *Collinsella aerofaciens*
- *B. intestinalis-like phylotype*
- *Fecalibacterium (Faecalibacterium prausnitzii)*
- *Bifidobacteria*
- *Ruminococcaceae*
- *Erysipelotrichaceae*
- *Methanobacteriaceae*
- *Prevotella*
- *Lachnospira*
- *Parasutterella*

- *Turicibacter*
- *Enterococcus*
- *Weissella*
- *Oxalobacter*
- *Oceanobacillus*
- *Methanobrevibacter*



- *Proteobacteria*
- *Firmicutes (Lachnospiraceae)*
- *Lactobacillus spp.*
- *Enterobacteriaceae*
- *Clostridiales*
- *Bacteroides*
- *Faecalitalea*
- *Prevotella*
- *Dorea*
- *Veillonella spp.*
- *R. bromii-like phylotype*
- *Christensenellaceae*
- *Akkermansia*
- *Methanobrevibacter*

Surdea Blaga et al, 2024

NUTRITIONAL BENEFIT OF SOURDOUGH

Nutritional benefits of sourdoughs: A systematic review

	Blood Glucose response (N = 20*)	Healthy individuals N = 14, n = 263	Individuals with metabolic disease N = 6, n = 78	**CONFLICTING EVIDENCE** ➢ 50% of studies showing NO significant differences ➢ Different cereals, milling types, recipes and fermentation conditions used
	Appetite & Satiety markers (N = 7*)	Healthy individuals N = 7, n = 147		**CONFLICTING EVIDENCE** ➢ Limited number of studies available ➢ Some benefits shown, but the effect of sourdough *per se* cannot be identified
	Gastrointestinal outcomes (N = 7*)	Healthy individuals N = 4, n = 90		**CONFLICTING EVIDENCE** ➢ Conflicting results regarding the ability of sourdough bread to decrease gastrointestinal discomfort in healthy individuals
		Individuals with IBS N = 3, n = 170		**SOME EVIDENCES** ➢ Studies showed the ability of sourdough to lower the immune response or gastrointestinal discomfort in subjects suffering from IBS
	Cardiovascular health markers (N = 7*)	Healthy individuals N = 4, n = 73	Individuals with metabolic disease N = 3, n = 42	**CONFLICTING EVIDENCE** ➢ NO significant differences between groups for most markers ➢ Significantly decreased LDL levels observed in one study only

* *Primary & secondary outcomes*

Ribet L. et al, Advances in Nutrition, 2023

PASTA MADRE, GRANO BIOSIMBIOTICO E IBS

- ✓ Studio pilota, interventistico, randomizzato controllato, doppio cieco.

- ✓ Obiettivo primario:
  Valutare se il consumo di pane a pasta madre prodotto con grano biosimbiotico è in grado di modulare il microbiota intestinale umano, con potenziali effetti benefici in soggetti affetti da IBS.

PASTA MADRE, GRANO BIOSIMBIOTICO E IBS

✓ Obiettivi secondari:

Valutare l'effetto del consumo di pane lievito madre realizzato con grano biosimbiotico:

- sui parametri clinici di IBS rispetto al gruppo controllo, misurati mediante IBS-Severity Scale (IBS-SS) e Visual Analogical Scale (VAS)
- sulla qualità di vita del soggetto, rispetto al gruppo controllo, misurata mediante la (Irritable Bowel Syndrome Quality of Life (IBS-QoL)
- sui parametri antropometrici e valori pressori, rispetto al gruppo controllo
- su parametri biochimici relativi all'assetto metabolico dell'individuo (profilo glicemico, profilo lipidico, PCR, uricemia), rispetto al gruppo controllo
- sulla variazione dei livelli ematici di citochine proinfiammatorie, rispetto al gruppo controllo

PASTA MADRE, GRANO BIOSIMBIOTICO E IBS

Inclusione di pazienti che afferiscono agli ambulatori dell'UOC di Gastroenterologia ed Endoscopia Digestiva di Forlì-Cesena con diagnosi di IBS (sec. Criteri Roma IV)

30 pz «gruppo test»
30 pz «gruppo controllo»

- «***Pane test***», pane realizzato con grano biosimbiotico (prodotto da 39 aziende appartenenti al Consorzio Romagna Distretto Biosimbiotico) e lievitazione naturale con pasta madre
- «***Pane controllo***», prodotto industrialmente, con farine provenienti da agricoltura convenzionale, senza lievitazione naturale

PASTA MADRE, GRANO BIOSIMBIOTICO E IBS

Durata dello studio per ogni soggetto: 6 mesi (3 mesi test – 3 mesi wash out)

Raccolta campioni biologici (feci, sangue, urine, saliva) al T0, T6, T12, T24
Periodiche valutazioni nutrizionali e gastroenterologiche

Feci: Analisi microbiota fecale 16S rRNA e 18S rRNA, Analisi metagenomica
Urina: analisi metabolomica
Saliva: dosaggio cortisolo

ONE-HEALTH


SAFER ENVIRONMENT
HEALTHY ANIMALS
ONE HEALTH
HEALTHY HUMANS

TECNOPOLO
FORLÌ-CESENA
EMILIA-ROMAGNA

GRAZIE
PER L'ATTENZIONE

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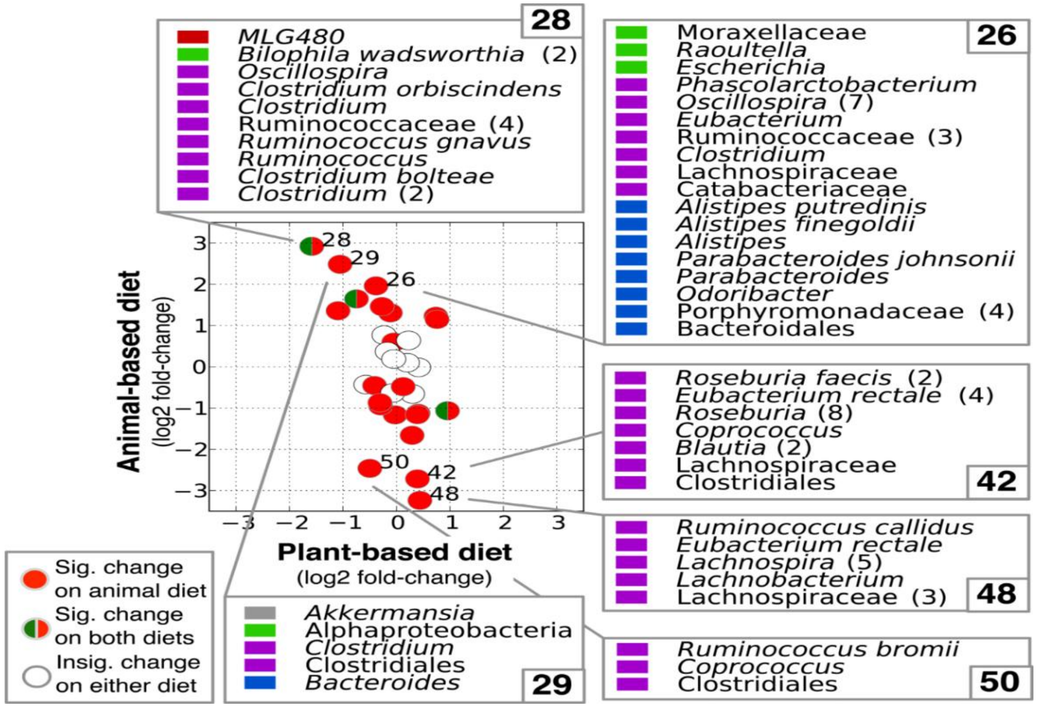
Take home message

- **Gut microbes are responsible for our health**
- **Gut microbiome is the only genome we can modify**
- **The right diet for the right microbiome**
- **The interplay between human individual, nature, food, antibiotics and environment**

DIET & GUT MICROBIOTA

The short-term modification of diet alters microbial community structure and microbial gene expression

The animal-based diet increases the abundance of bile-tolerant microorganisms (Alistipes, Bilophila, and Bacteroides) and decreases the levels of Firmicutes that metabolize dietary plant polysaccharides (Roseburia, Eubacterium rectale, and Ruminococcus bromii)



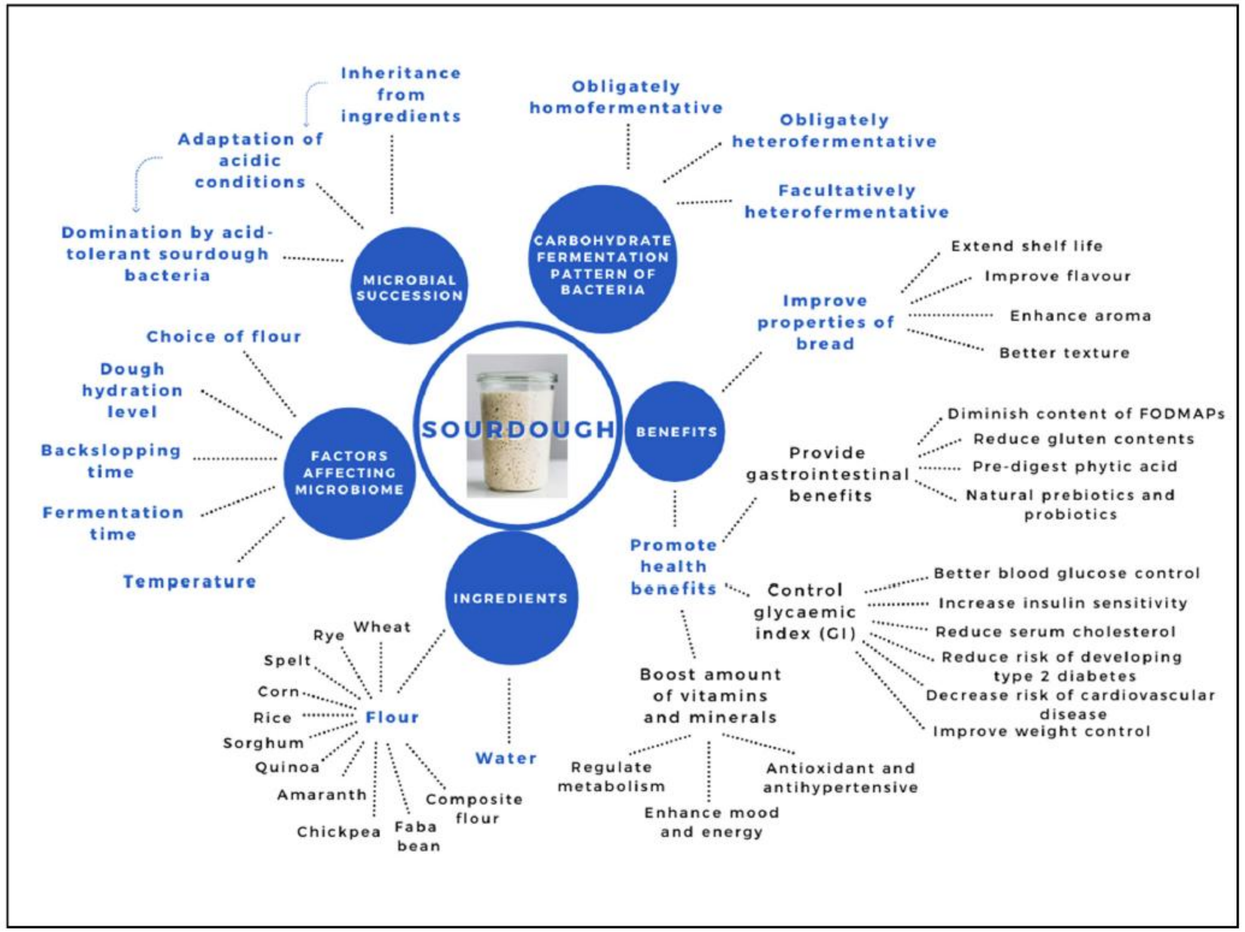
The human gut microbiome can rapidly switch between herbivorous and carnivorous functional profiles.

David LA et al. Nature. 2014

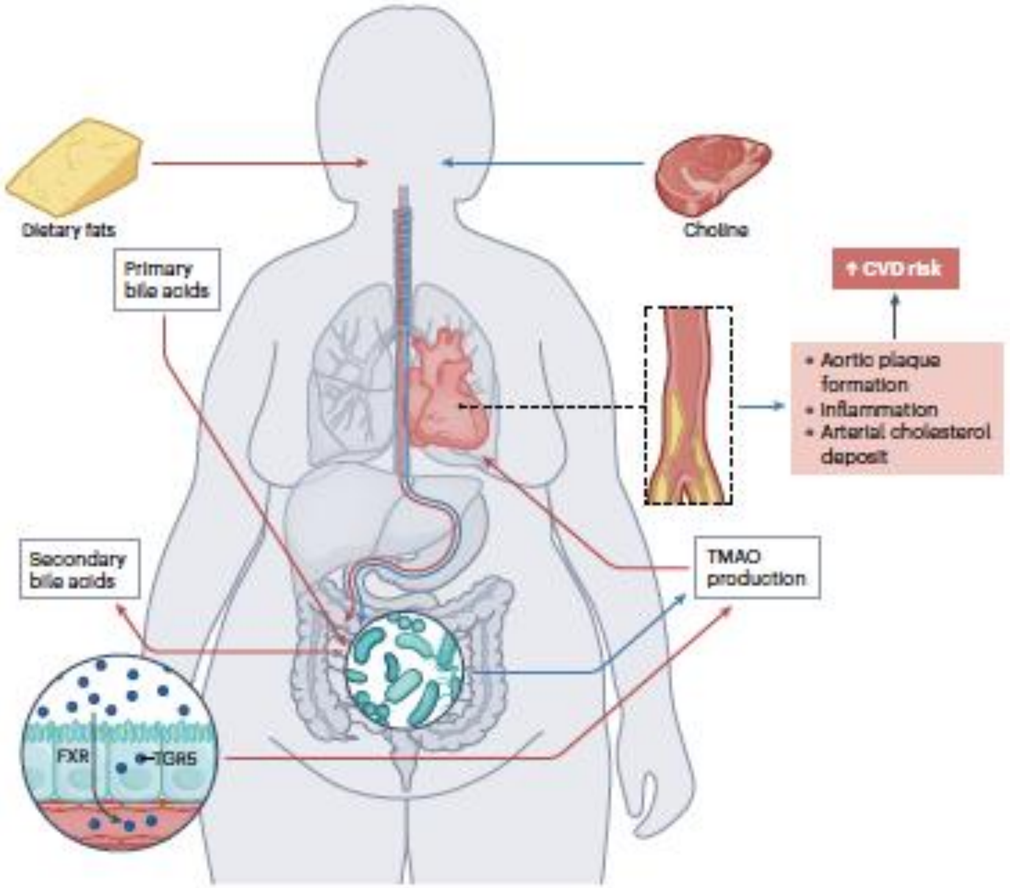
Dieta per la salute nostra e del pianeta

1	**Buono**	Il cibo è piacere
2	**Pulito**	Senza residui di pesticidi/ senza additivi di sintesi → Prodotti Biologici
3	**Sano**	Meno zuccheri, grassi, carne e proteine animali; Più proteine vegetali, cereali integrali, fibre, alimenti protettivi
4	**Fresco**	Meno impatto dei processi industriali, più salutare
5	**Di stagione**	Meno impatto per l'ambiente, più salutare per noi (la Natura sa quando darci il meglio)
6	**Locale**	Meno impatto sull'ambiente, più salutare per noi
7	**Giusto**	Senza sfruttamento (3x2; il prezzo vero; il discount)
8	**Fatto da te**	Limitare le preparazioni industriali
9	**Diversità**	La varietà di alimenti facilita il raggiungimento del giusto apporto di nutrienti, meno monotonia nel piatto più biodiversità nelle campagne e nel microbiota intestinale
10	**Senza integratori**	Una dieta corretta non necessita di integrare nulla

Le evidenze scientifiche sui benefici della pasta madre sulla salute umana

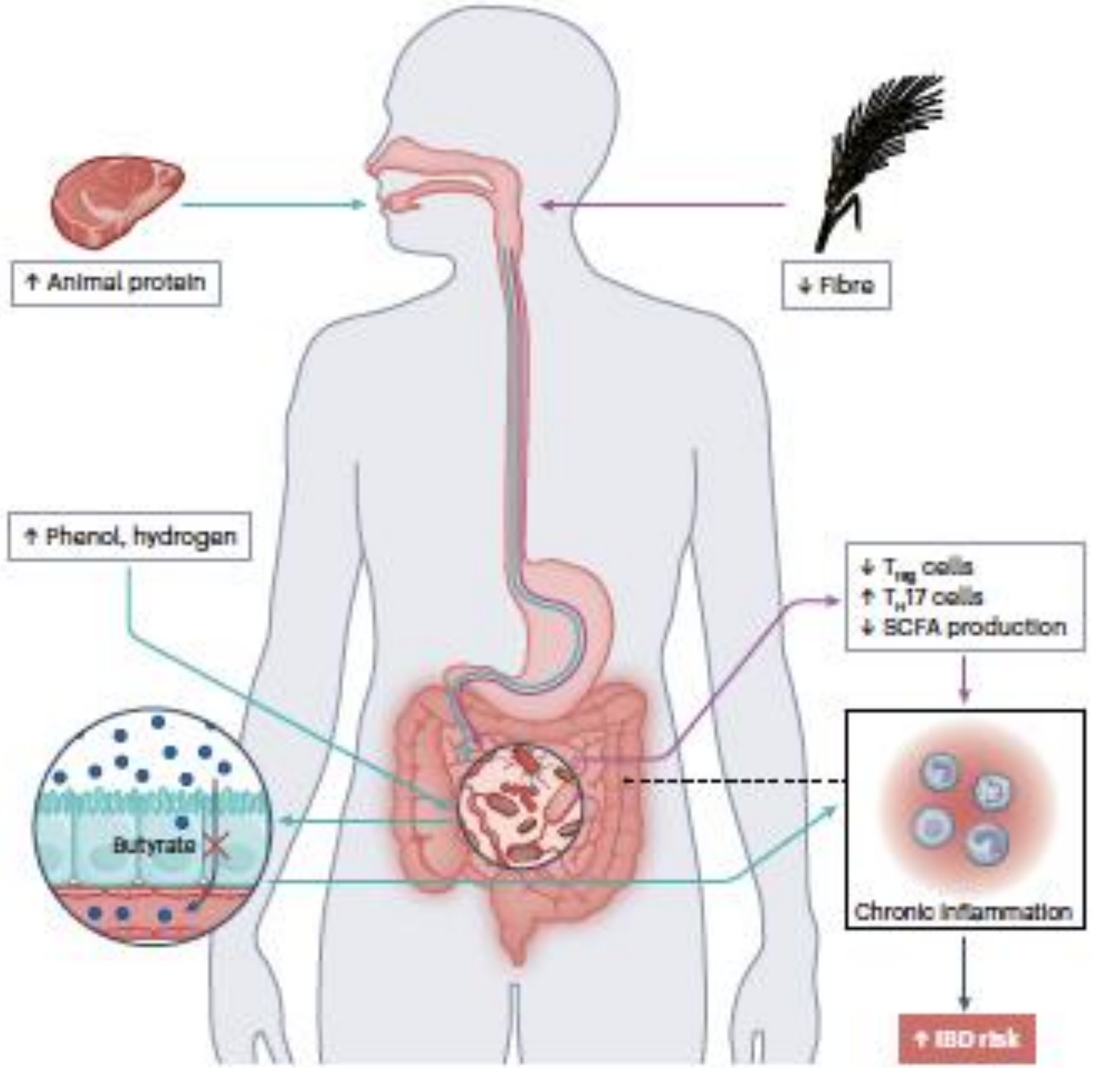


DIET, THE MICROBIOME AND METABOLIC SYNDROME



Ross FC et al, nature reviews microbiology, 2024

DIET, THE MICROBIOME AND INTESTINAL DISORDERS



Ross FC et al, nature reviews microbiology, 2024

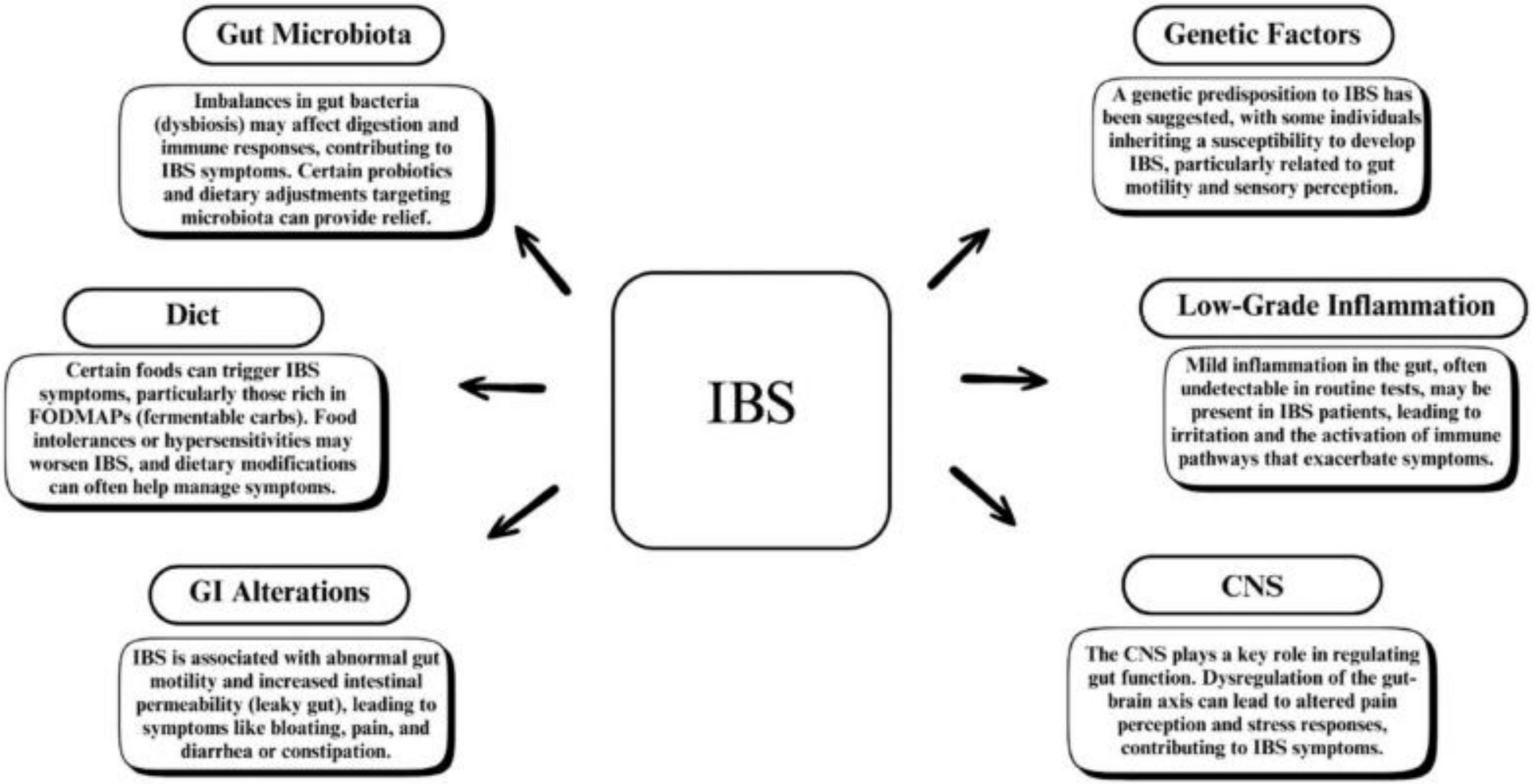
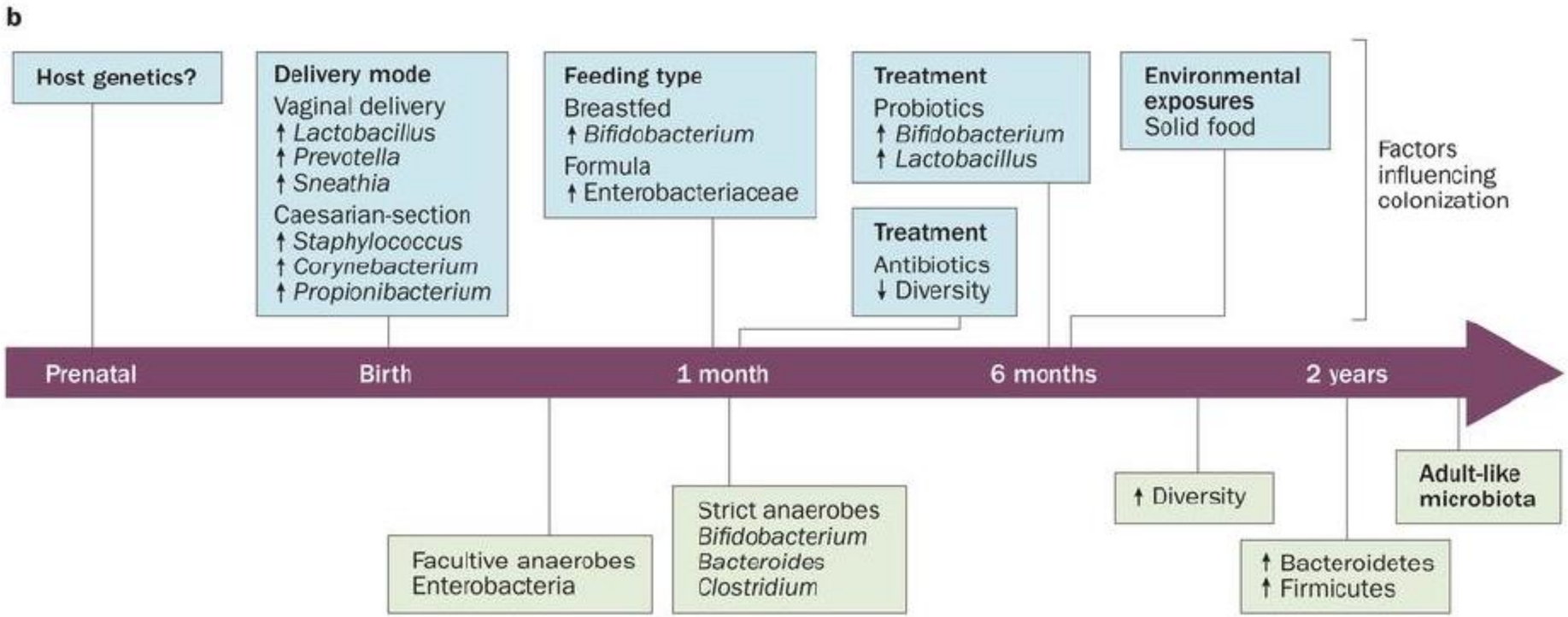


Figure 2. An overview of suggested factors involved in IBS.

EARLY DETERMINANTS OF GUT MICROBIOTA COMPOSITION



Verdu et al, Nat Rev Gastro Hepatol 2015