

Das menschliche Mikrobiom

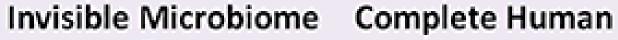
Mehr, als wir erwartet haben

Tom Fox

08.10.2021

Visible Organs

► ~10⁻¹⁴ cells ~ 23000 genes





► ~10⁻¹⁴ million microbes

~ 9 million genes

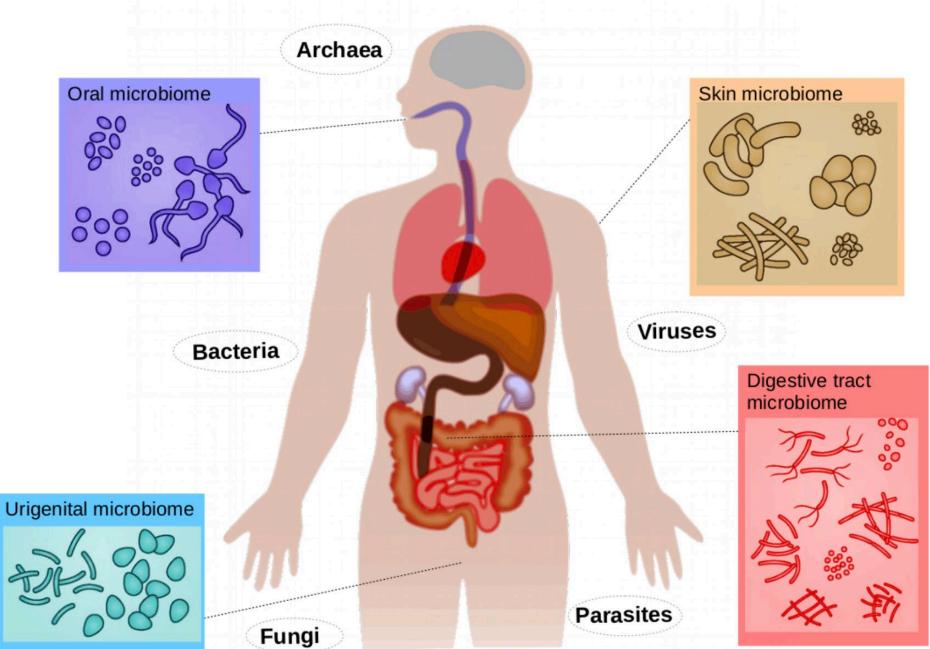


Normal functioning body



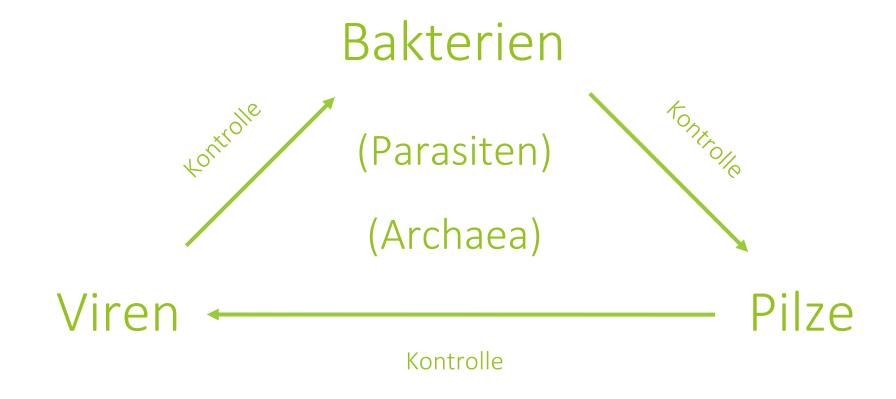
Human Microbiome







Das System kontrolliert sich selbst





Fragen:

- Ist mein Lebensstil gesund?
- Was muss ich tun, um ein optimales Mikrobiom zu erhalten?
- Wenn mein Mikrobiom nicht "ok" ist, was tun? Gibt es Protokolle?
- Kann ich mit einer Mikrobiomveränderung Krankheiten beeinflussen?



Was erwartet uns?



Folgen / Konsequenzen eines

gestörten Mikrobioms



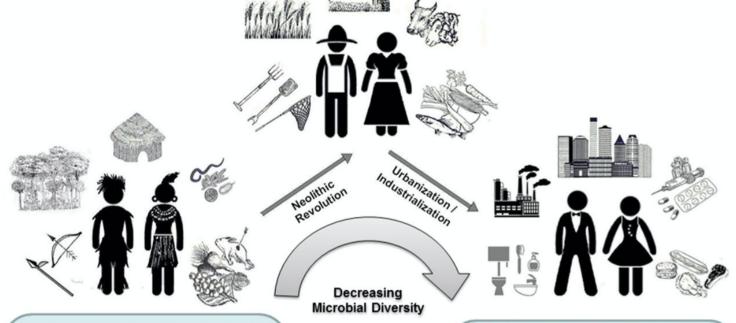


Mehr Fortschritt weniger Diversität

B Traditional farming or fishing population

Microbial Diversity: High
Enriched Taxa: Prevotella, Succinovibrio,
Treponema, Ruminococcus, Bacteroides
[Clostridiaceae, Rickenellaceae, Bacteroidetes,
Firmicutes, Proteobacteria & Spirochaetes]
Depleted Taxa: Low abundance of Prevotella

compared to ancient population



A Remote hunter gatherer population

Microbial Diversity: Very High
Enriched Taxa: Prevotella, Succinovibrio,
Treponema, Cyanobacteria, Tenericutes,
Clostridium, Catenibacterium, Eubacterium,
Lachnospira, Salmonella [Enterococcaceae,
Firmicutes, Proteobacteria, Spirochaetes,
Clostridiaceae & Euryarchaeota]
Depleted Taxa: Lachnospiraceae, Bacteroidales

Western (US/European) urban industrialized population

Microbial Diversity: Low
Enriched Taxa: Bacteroides, Bifidobacterium,
Ruminococcus, Blautia, Dorea [Actinobacteria,
Firmicutes, Rickenellaceae]
Depleted Taxa: Prevotella, Xylanibacter &
Treponema



Und warum? Beispiele ...

- sauberes Trinkwasser
- häufigere Kaiserschnittgeburten
- häufiger vorzeitiger Einsatz von Antibiotika
- Rückgang des "Stillens"
- kleinere Familien
- Hygieneverhalten
- zu saubere Nahrung
- Toxine, Schwermetalle, Nanopartikel
- hochkalorische, faserstoffarme Nahrung

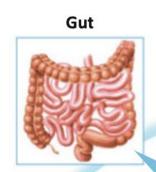


Mikrobiom: die klassische Sichtweise

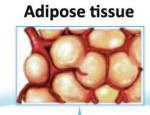
- Fermentieren von Faserstoffen
- Produktion von Vitaminen
- mechanische Barriere
- Produktion an kurzkettigen Fettsäuren

Wie gesagt -

ein wenig mehr ...



Enteroendocrine metabolism

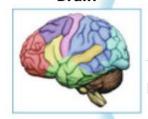


Fat storage Skeletal muscle



Energy metabolism

Brain



Behavior and motor activity

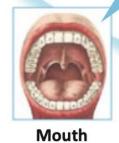


Fat liver metabolism/ hepatic steatosis



Liver

Periodontitis



Tissue Lipid composition



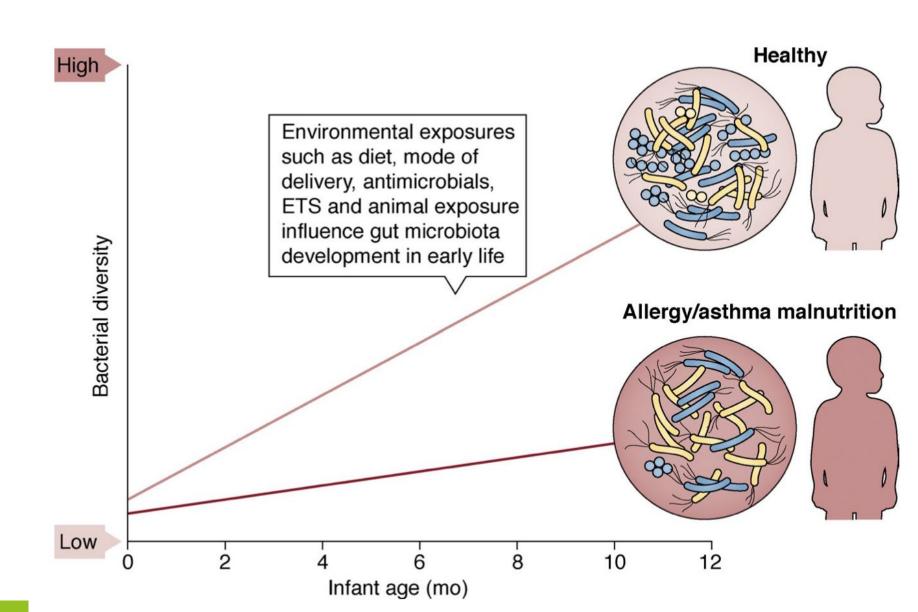
Eye

Blood vessel Heart

Burcelin 2015



... und es beginnt früh zu arbeiten



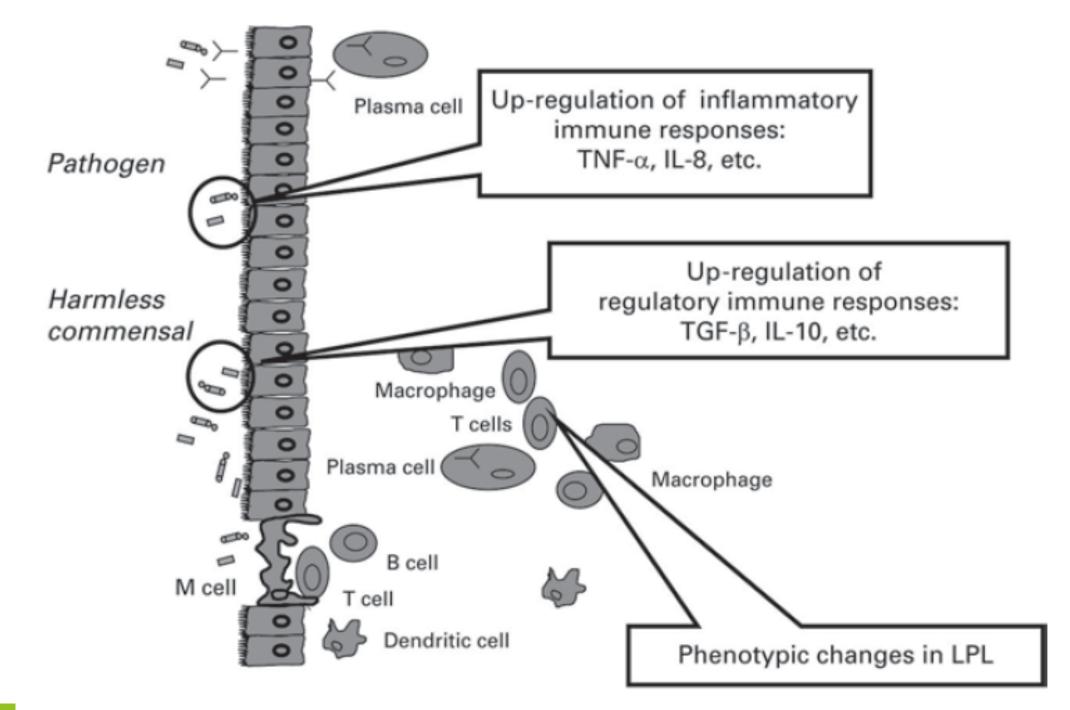


Folgen / Konsequenzen eines

gestörten Mikrobioms

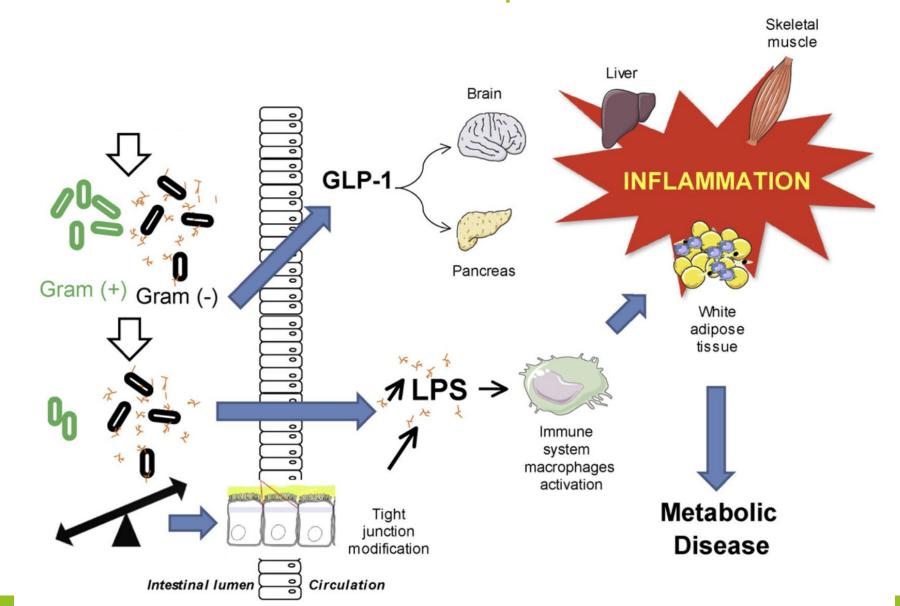
Wichtig für unser Immun-system

Guarner 2006

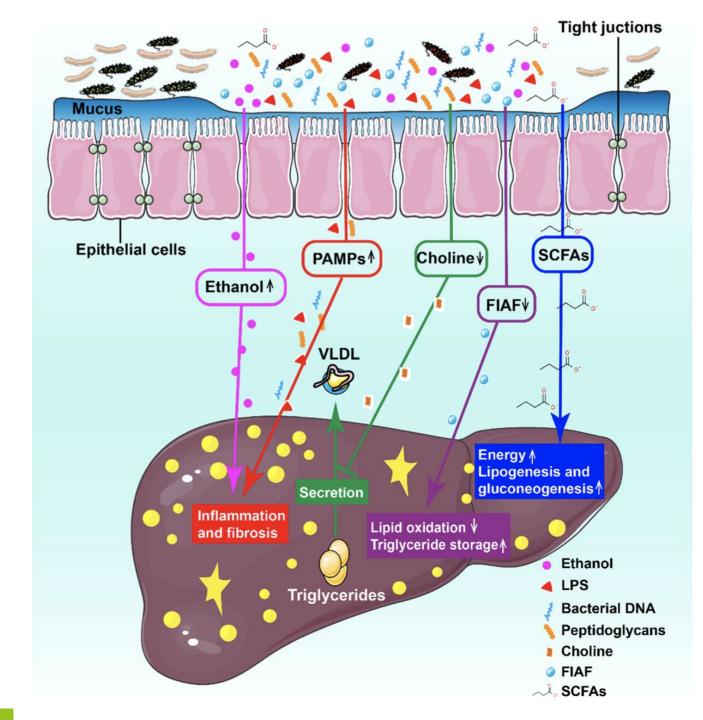




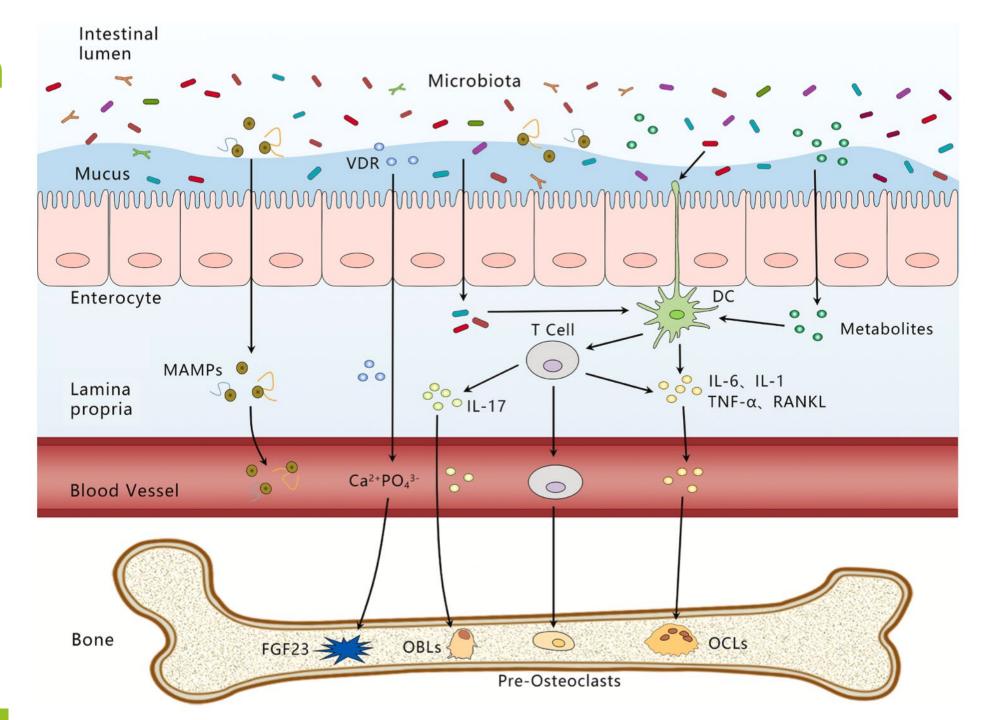
Falsche Flora = Stoffwechselprobleme



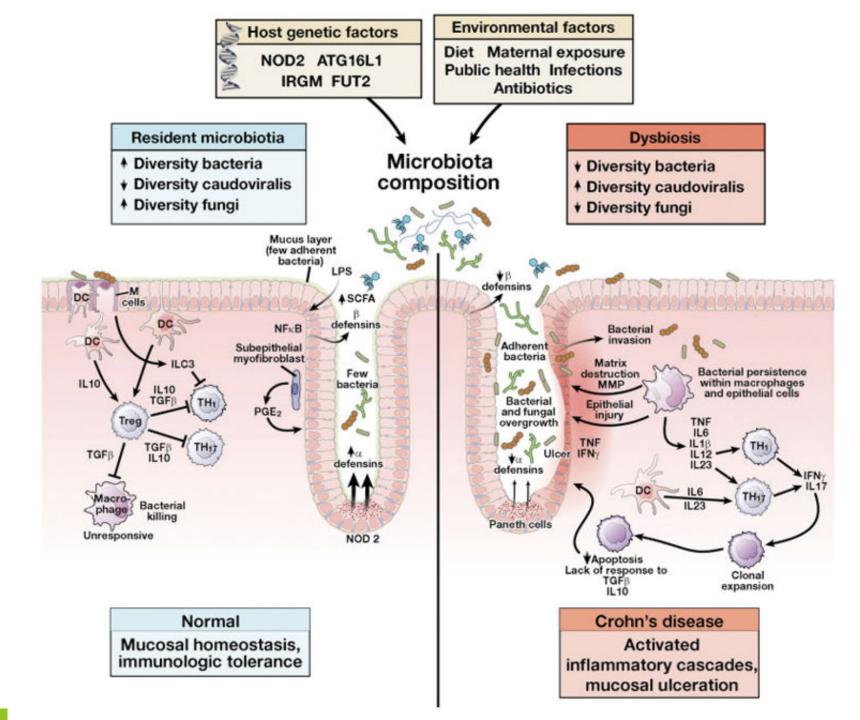
Mikrobiom und NAFLD



Mikrobiom und Knochen

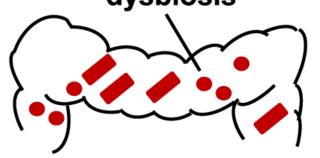


Und leider auch "Entzündung"



... und dies nicht nur im Darm

Environmental factors dysbiosis

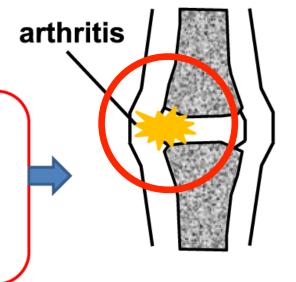


Smoking Hormones Infection



Gut microbiota

Prevotella copri L. salivarius Collinsella





Periodontal bacteria

P. gingivalis

A. actinomycetemcomitans

Production of autoantibody (ACPA, RF)

←Healthy→ ←pre-clinical stages→

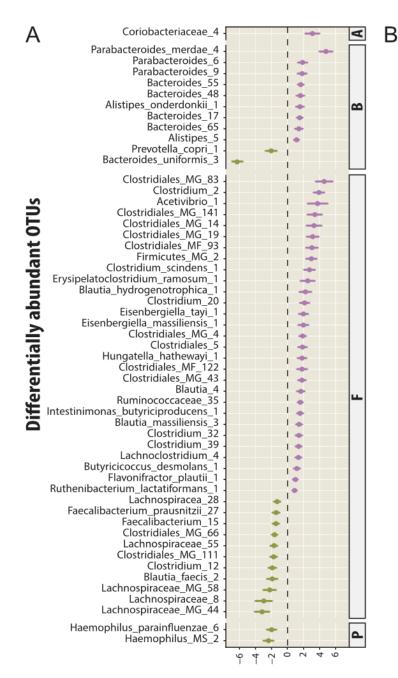
←Rheumatoid arthritis-

Genetic backgrounds

•HLA-DRB1 •PTPN22 etc.

Maeda 2019

Darmflora und Fibromyalgie



Parabacteroides merdae Clostridium scindens Erysipelatoclostridium ramosum Blautia hydrogenotrophica Eisenbergiella tayi Eisenbergiella massiliensis Hungatella hathewayi Intestinimonas butyriciproducens Alistipes onderdonkii Blautia massiliensis **Butyricicoccus desmolans** Flavonifractor plautii Ruthenibacterium lactatiformans

Faecalibacterium prausnitzii Blautia faecis Haemophilus parainfluenzae Prevotella copri **Bacteroides uniformis**

Minerbi 2019

Fold Change (log₂)

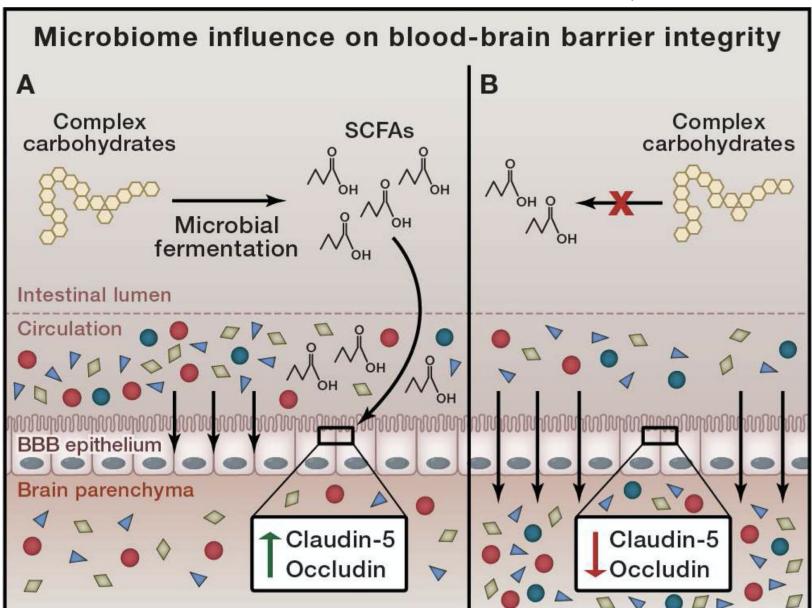
Fibromyalgia

Control

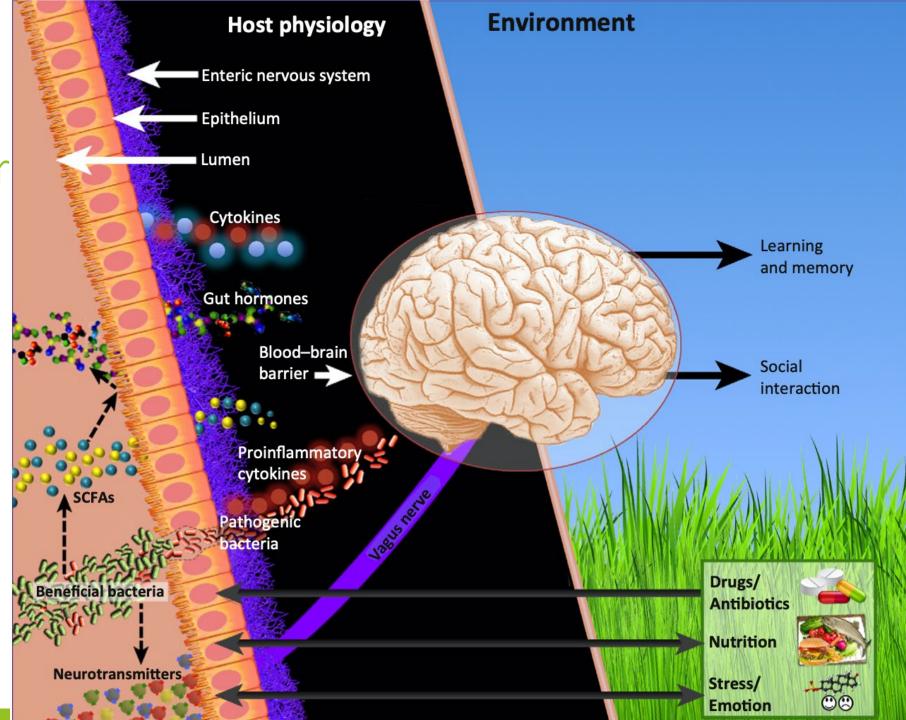
Das

ENERGETICA Natura.

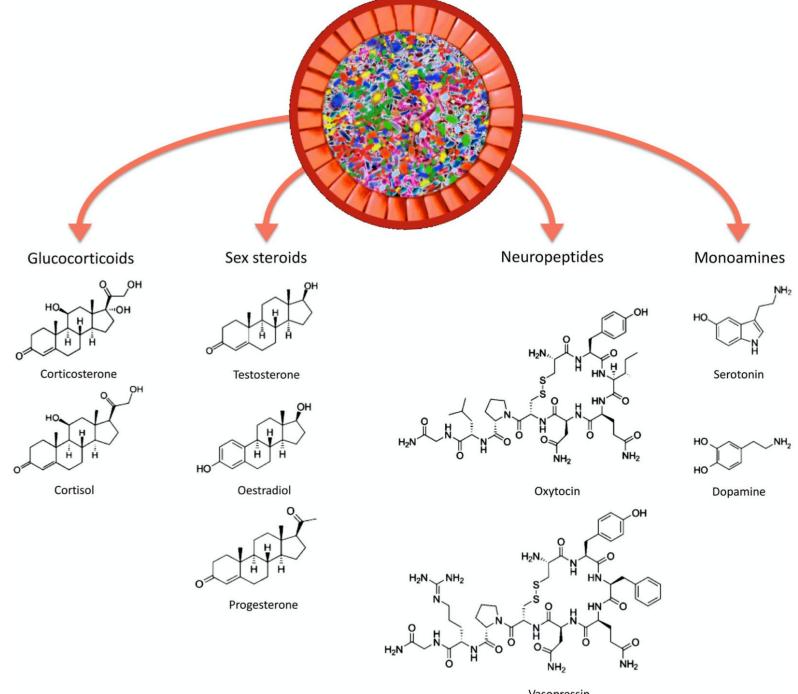
Darm-Mikrobiom ist verantwortlich für eine intakte Blut-Hirn-Schranke



Somit sind
Mikrobiom und
Gehirn untrennbar
verbunden



Das Mikrobiom hat Einfluss auf Hormone und Botenstoffe

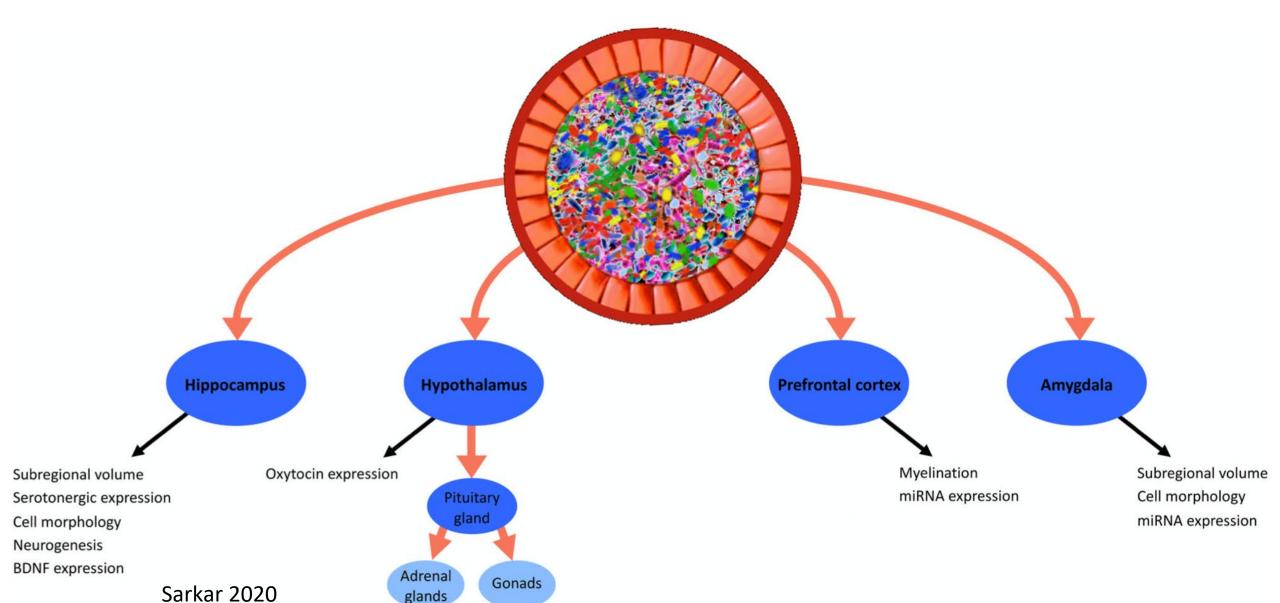


Sarkar 2020

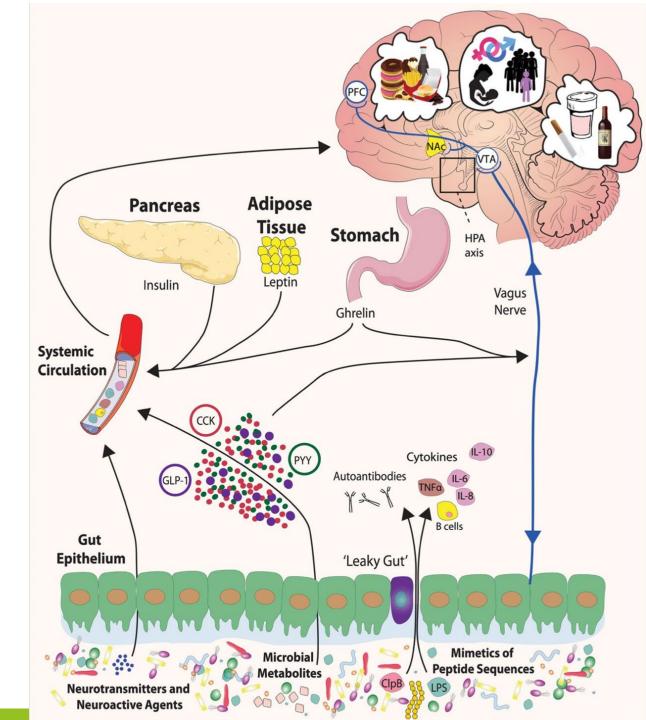
Vasopressin

Und auf die Gehirnaktivität

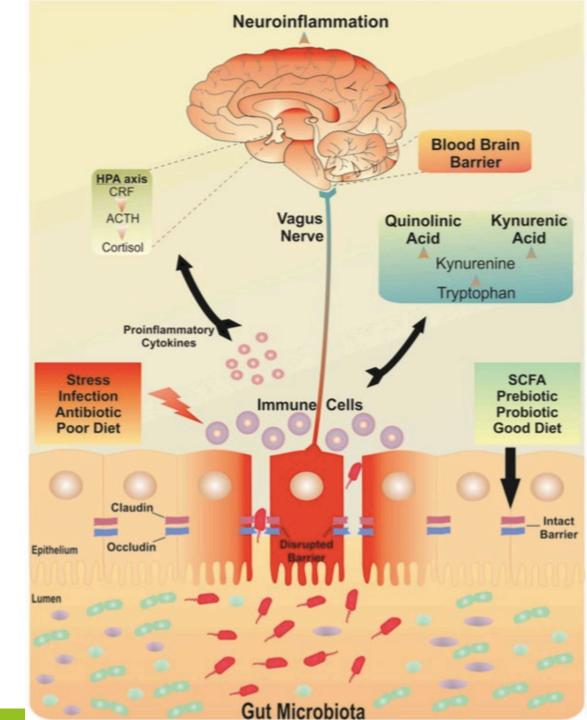




Sogar "Belohnung" ist abhängig vom Mikrobiom

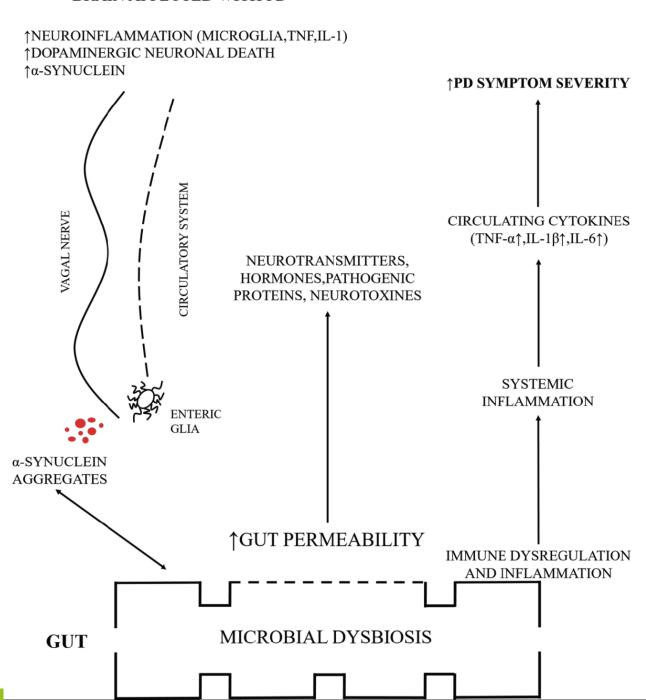


Mikrobiom und Neuroinflammation

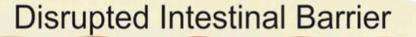


Mikrobiom, Leaky gut und Morbus Parkinson

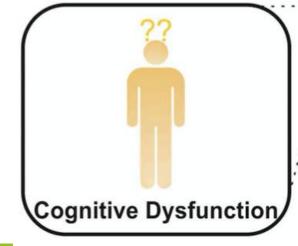
BRAIN AFFECTED WITH PD



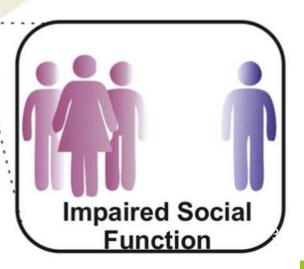










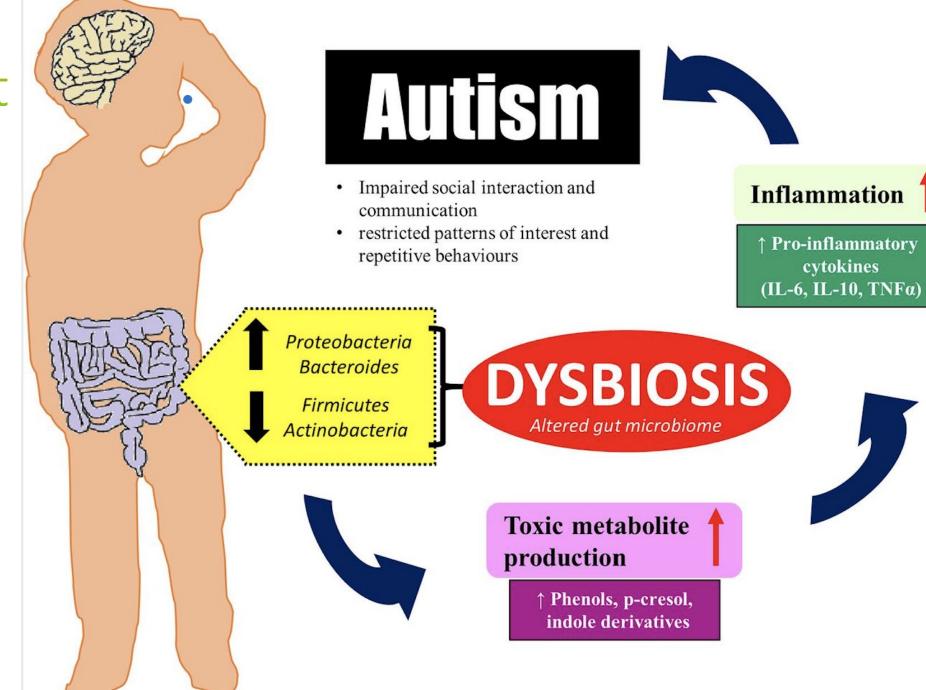


Darmbakterien beeinflussen unser Verhalten

Genus	Change in abundance	Behavioural trait/psychiatric condition	Study subject	References
Akkermansia	\downarrow	Autism	Children	[52]
	[↑]	Autism	Children	[53]
	↓	Stress	Mice	[54,55]
	↑	Sociability	Adults	This study
Corynebacterium	[↑]	Autism	Children	[56]
	\downarrow	Stress	Rats	[83]
	↓	Neurotic	Adults	This study
		tendencies		
Desulfovibrio	↑	Autism	Children	[60,80]
	\downarrow	Sociability	Adults	This study
Lactococcus	\downarrow	Autism	Children	[53,60]
	↑	Sociability	Adults	This study
Oscillospira	\downarrow	Autism	Children	[53]
	↑	Sociability	Mice	[94]
	\downarrow	Stress	Mice	[55,94,95]
	↑	Sociability	Adults	This study
Streptococcus	↓	Autism	Children	[53,60]
	[↑]	Depression	Adults	[82]
	↓	Neurotic	Adults	This study
		tendencies		
Sutterella	↑	Autism	Children	[52,65,96,97]
	[↓]	Autism	Children	[75]
	↑	Stress	Mice	[55]
	\downarrow	Sociability	Adults	This study

Johnson 2020

Und das geht sehr weit



Lee 2019



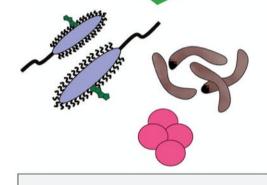


Bewegung

(onsequenzen

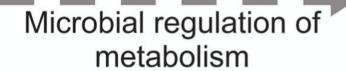


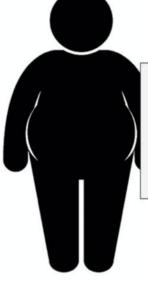




Microbiota

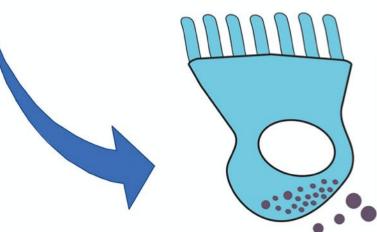
- Short chain fatty acids
- Secondary bile acids
- Structural components





Metabolism

- Glucose metabolism
- Insulin sensitivity
- Fat storage (Adiposity)
- Feeding and satiety



Hormones

- GLP-1
- PYY
- GIP
- 5-HT
- CCK

Kalorien vs. Nährstoffdichte



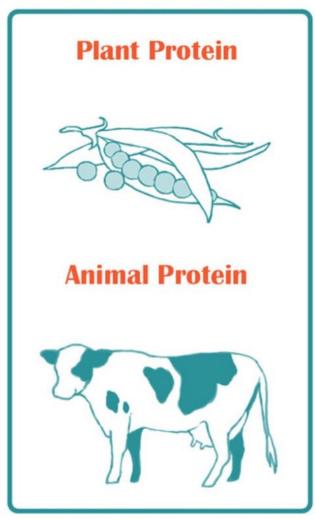
Healthy Food addiction High nutrient-to-calorie Low nutrient-to-calorie and/or obesity ratio ratio Complex carbohydrates Refined carbohydrates, High fibre sugar High fat ↑ Fibre degradation Low fibre ↑ Gut microbiome ↓ Fibre degradation diversity ↑ Abundance of ↓Gut microbiome diversity ↓ Abundance of mucus-stimulating microorganisms mucus-stimulating microorganisms ↑ Mucus thickness ↓ Mucus thickness mminmm, MMM Intact gut barrier **↓**Gut barrier

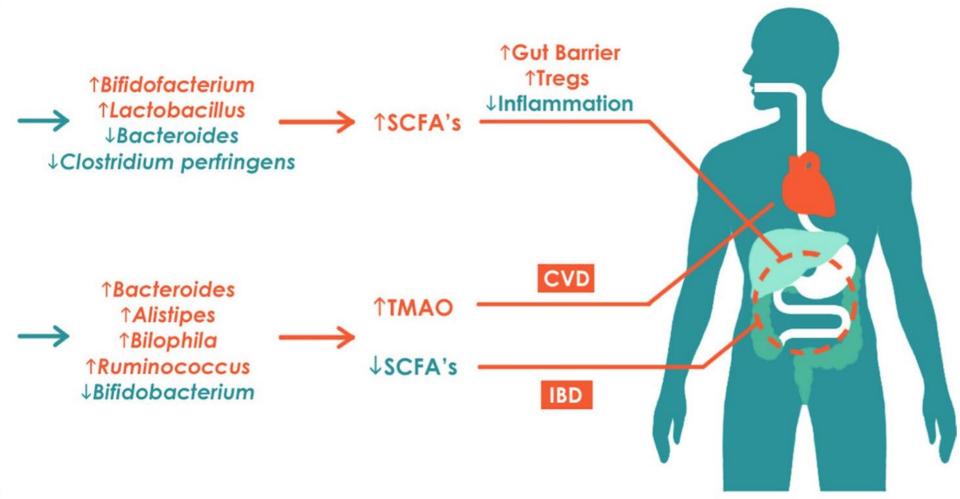
- Homeostatic control of ingestive behaviour
- Normal satiety mechanisms

- Metabolic endotoxaemia
- Neuroinflammation
- Compromised satiety mechanisms
- Imbalance between homeostatic and hedonic food intake regulation



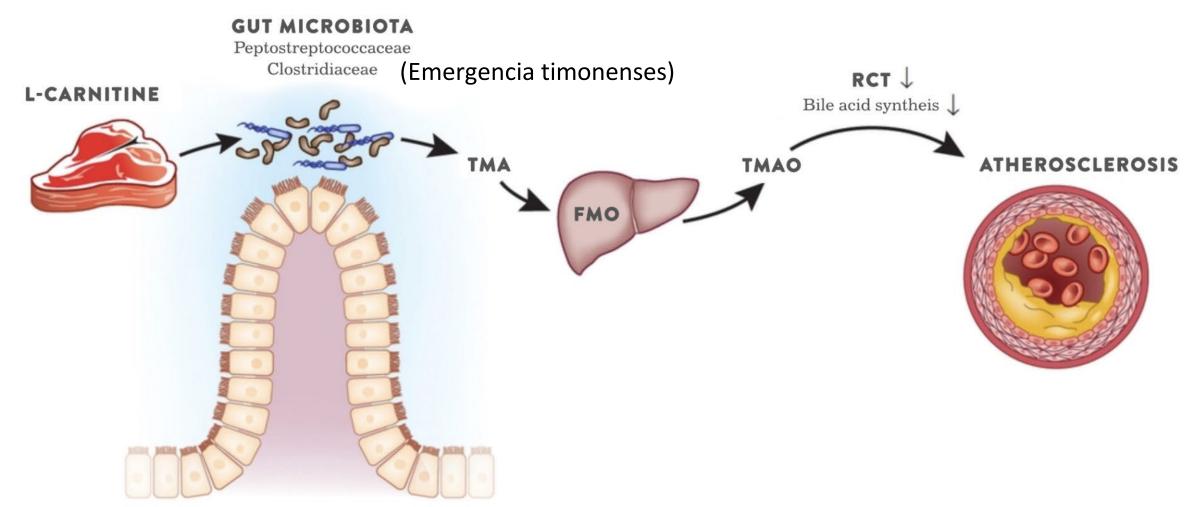
Pflanzliche vs. tierische Proteine



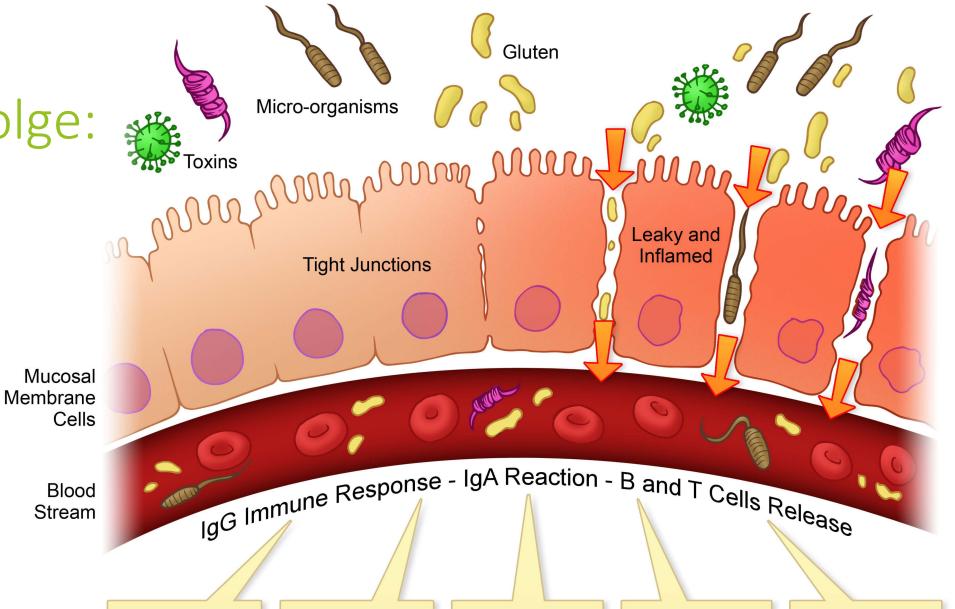








Mögliche Folge: Leaky Gut 1



Blood

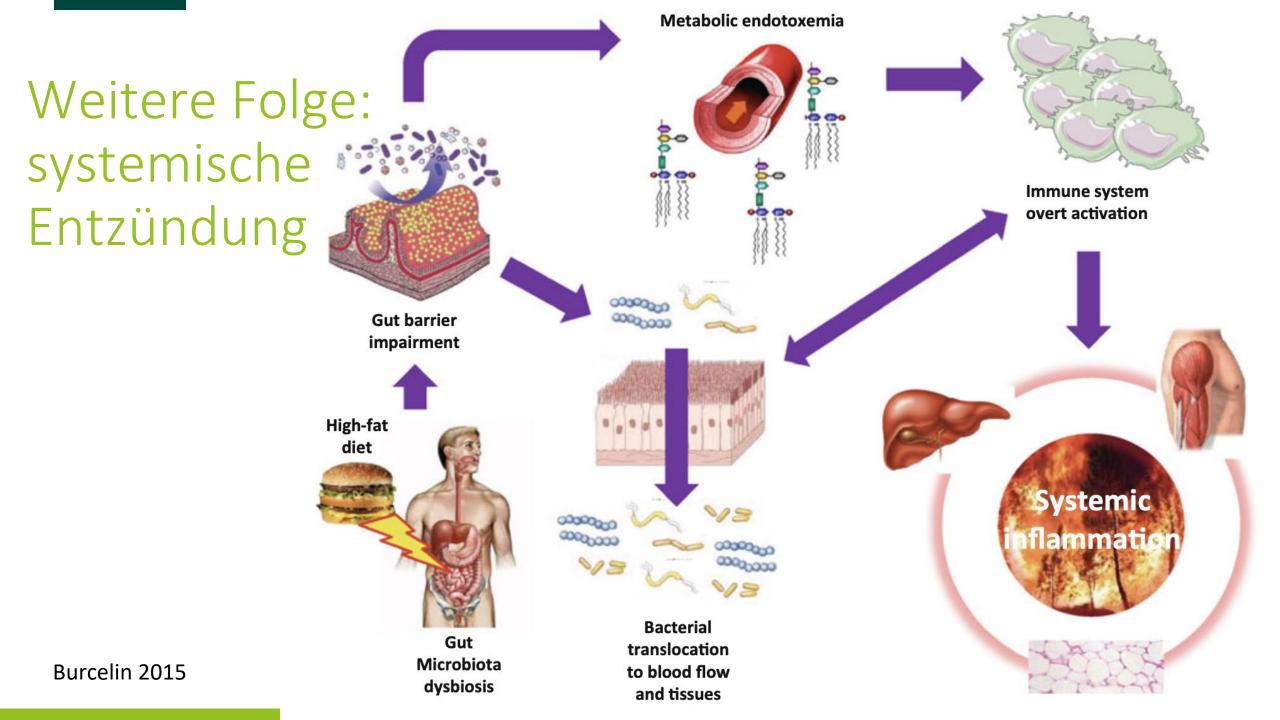
Nutrient Malabsorption

Autoimmunity

Food Intolerance

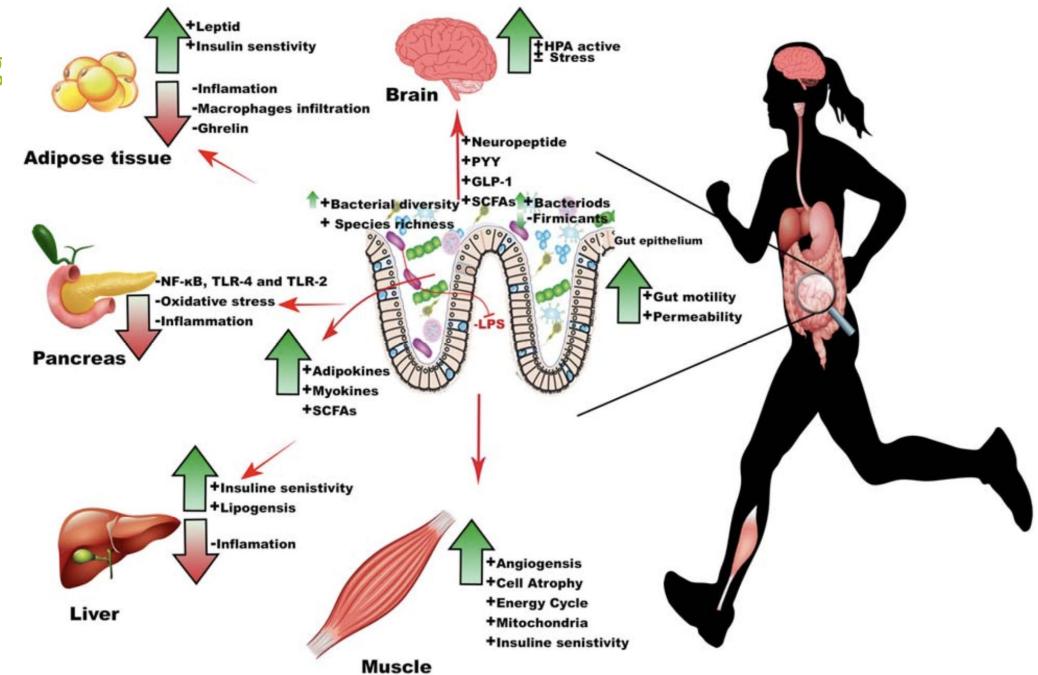
Blood-Brain **Barrier Breech**

Systematic Inflammation





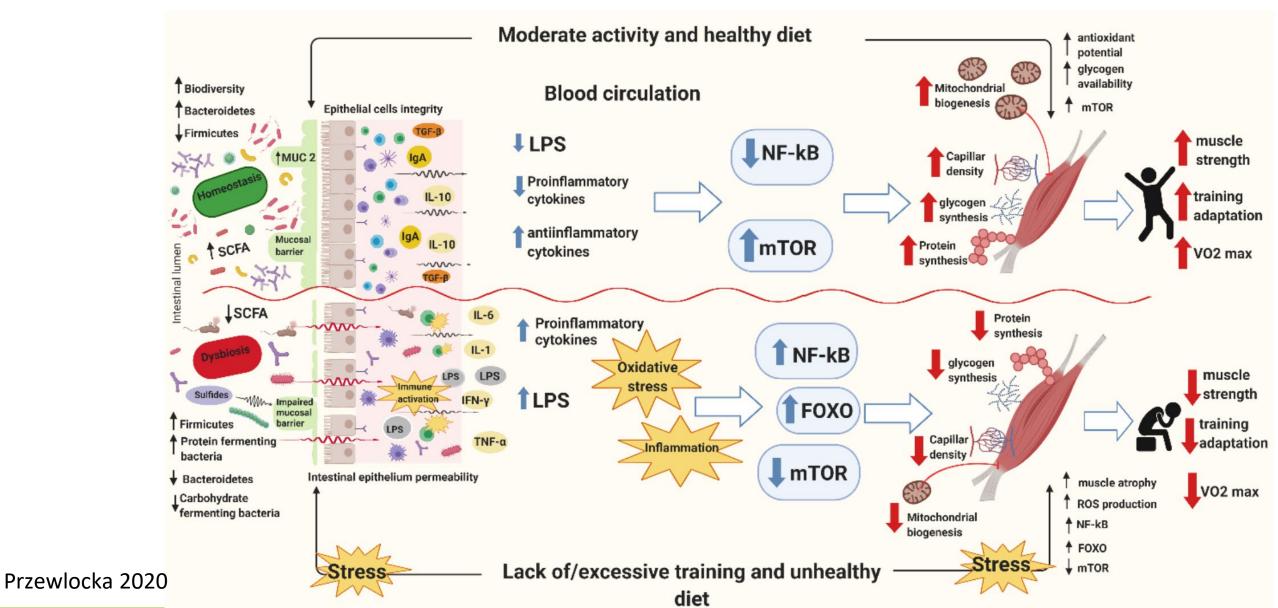
Bewegung



Sohail 2019

Bewegung oder Bewegungsmangel







Ernährung

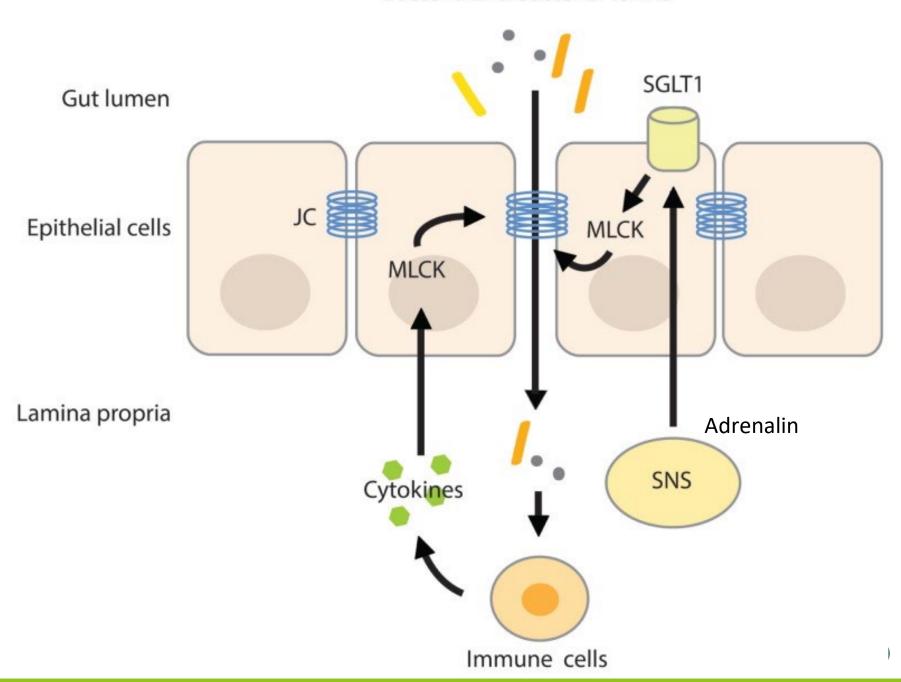
Bewegung



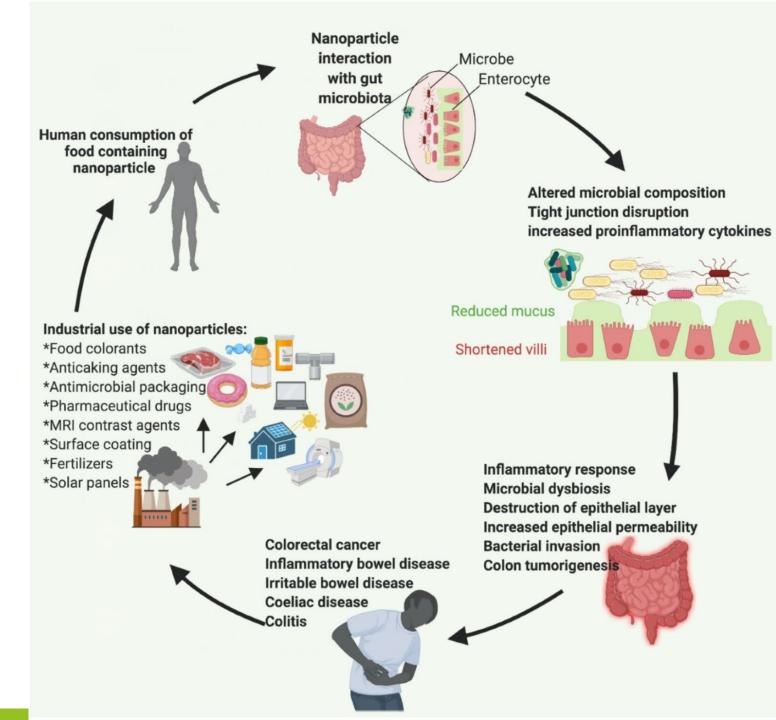
Konsequenzen

Bacteria and bacterial toxins

Leaky Gut 2: Stress

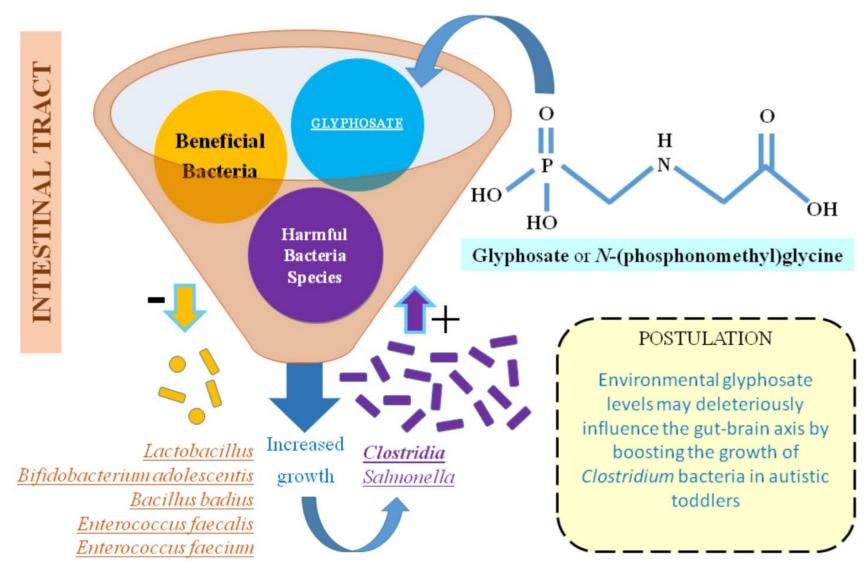


Nanopartikel und Mikrobiom

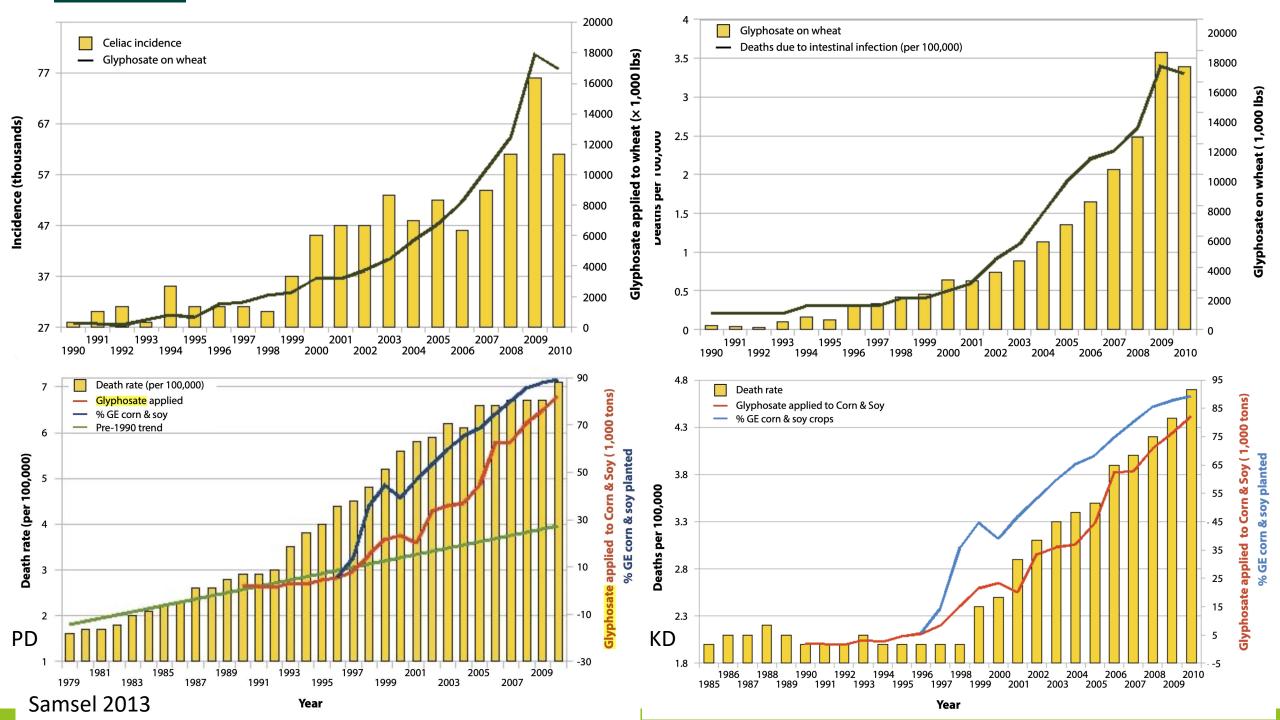


Glyphosat und Mikrobiom



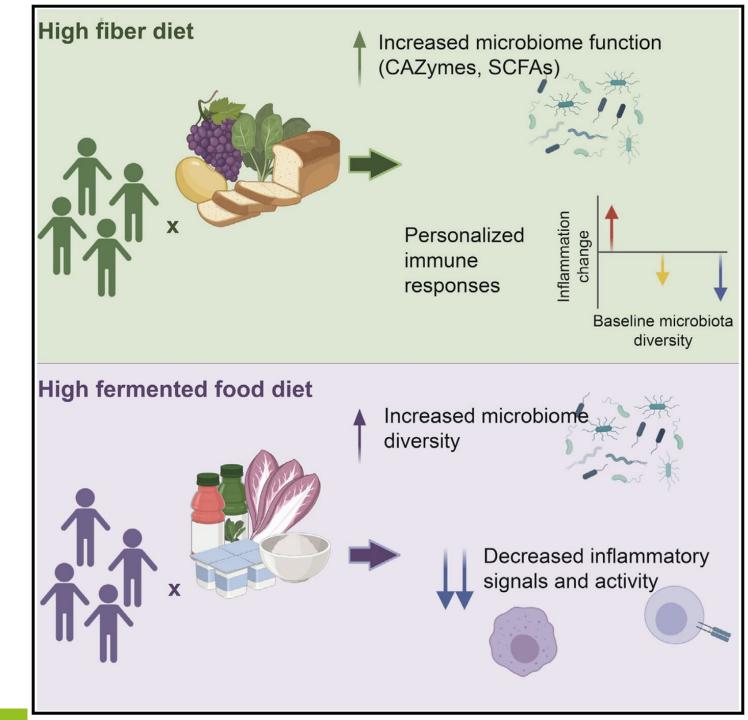


Argou-Cardozo 2018



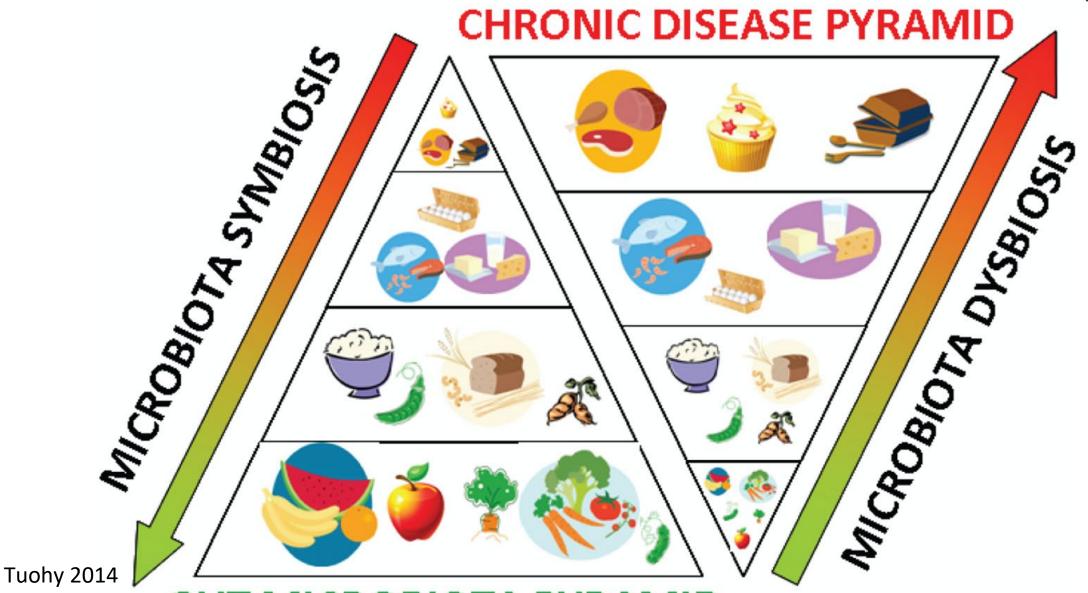


Faserstoffe <u>und</u> fermentierte Lebensmittel



Mediterranean v Western diet

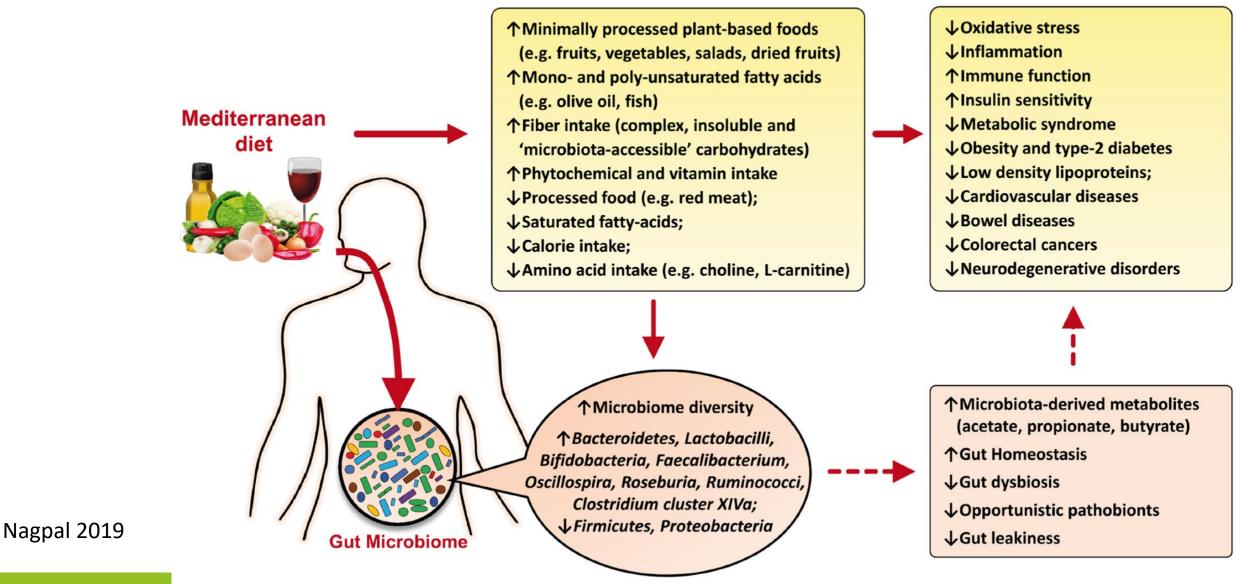




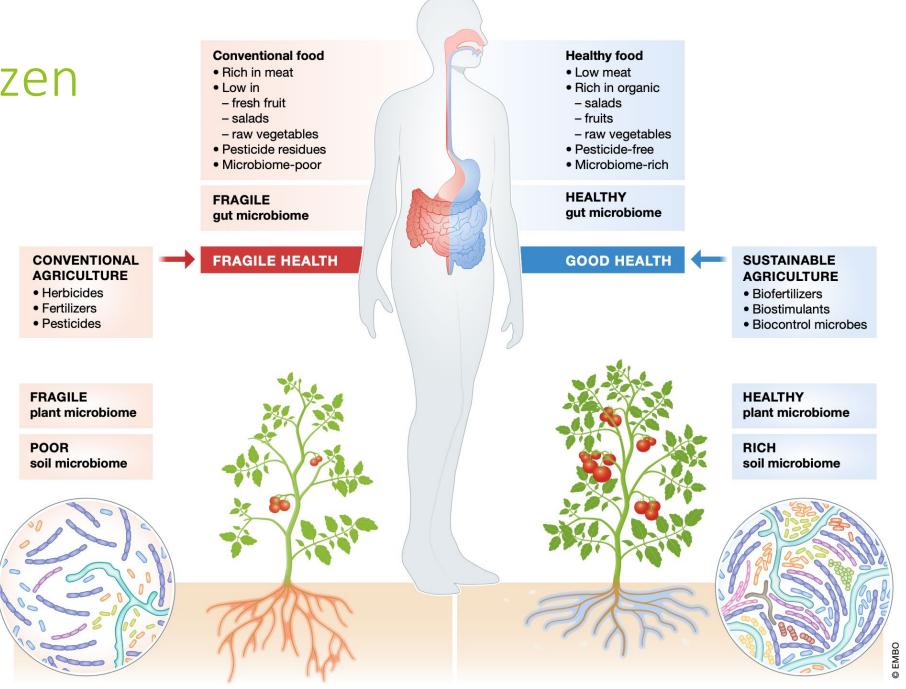
GUT MICROBIOTA PYRAMID

Warum mediterrane Ernährung?





Gesunde Pflanzen sind gesund



Sekundäre Pflanzenstoffe

Singh 2019

Some of the major dietary sources of polyphenols:













Coffee & Tea

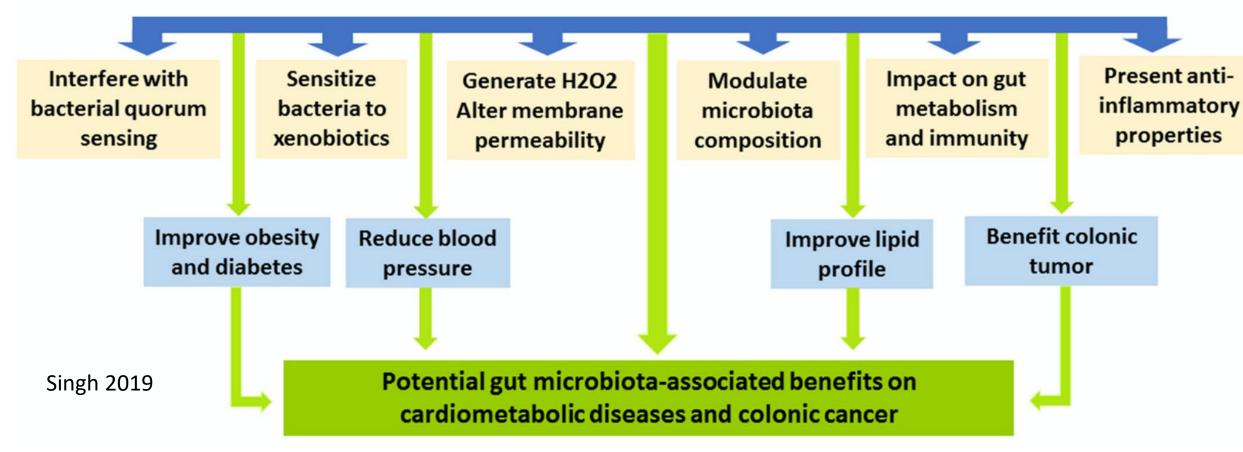
Cereals

Dark chocolate

Vegetables

Cocoa powder

Dietary POLYPHENOLS



Science of Food and Agriculture





Research Article

Mediterranean *sofrito* home-cooking technique enhances polyphenol content in tomato sauce

José Fernando Rinaldi de Alvarenga, Paola Quifer-Rada, Victoria Westrin, Sara Hurtado-Barroso, Xavier Torrado-Prat, Rosa M Lamuela-Raventós ⋈,

Abstract

Background

Sofrito, a basic culinary technique widely used in the Mediterranean, may preserve dietary polyphenols and enhance their intake in the Mediterranean population. The aim of this study was to investigate if the sofrito technique improves the polyphenol extractability in a tomato-based sofrito sauce.

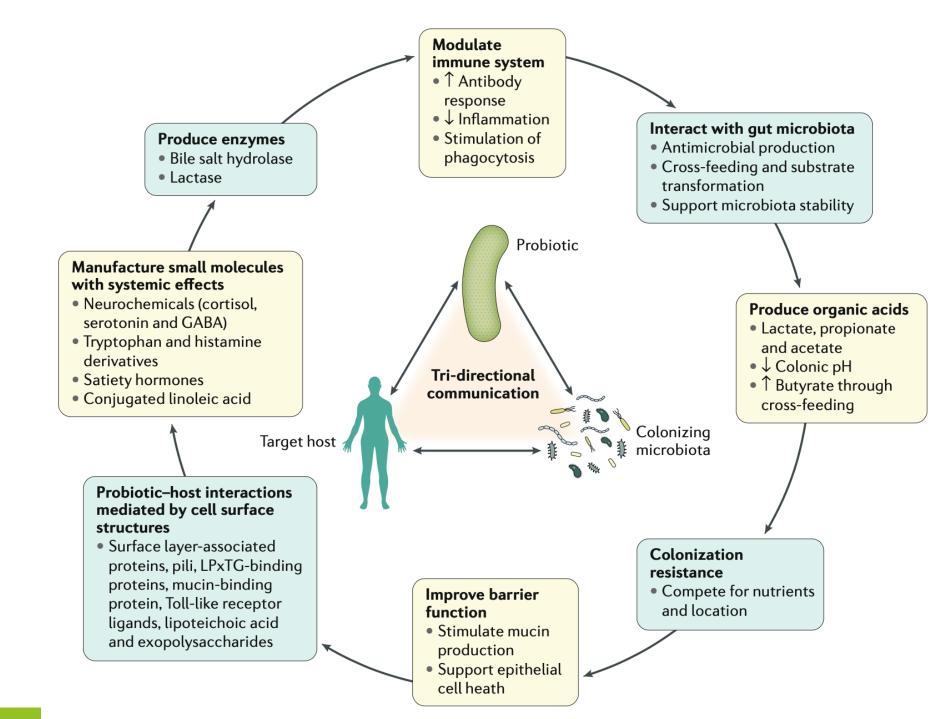
Results

A full factorial design was applied using mathematical models. The content of chlorogenic acid, ferulic acid hexoside and naringenin was higher in the *sofrito* sauce than in raw tomato. The bioaccessibility of some tomato polyphenols was enhanced by the presence of olive oil and they were protected from oxidation during the cooking process by the use of onion.

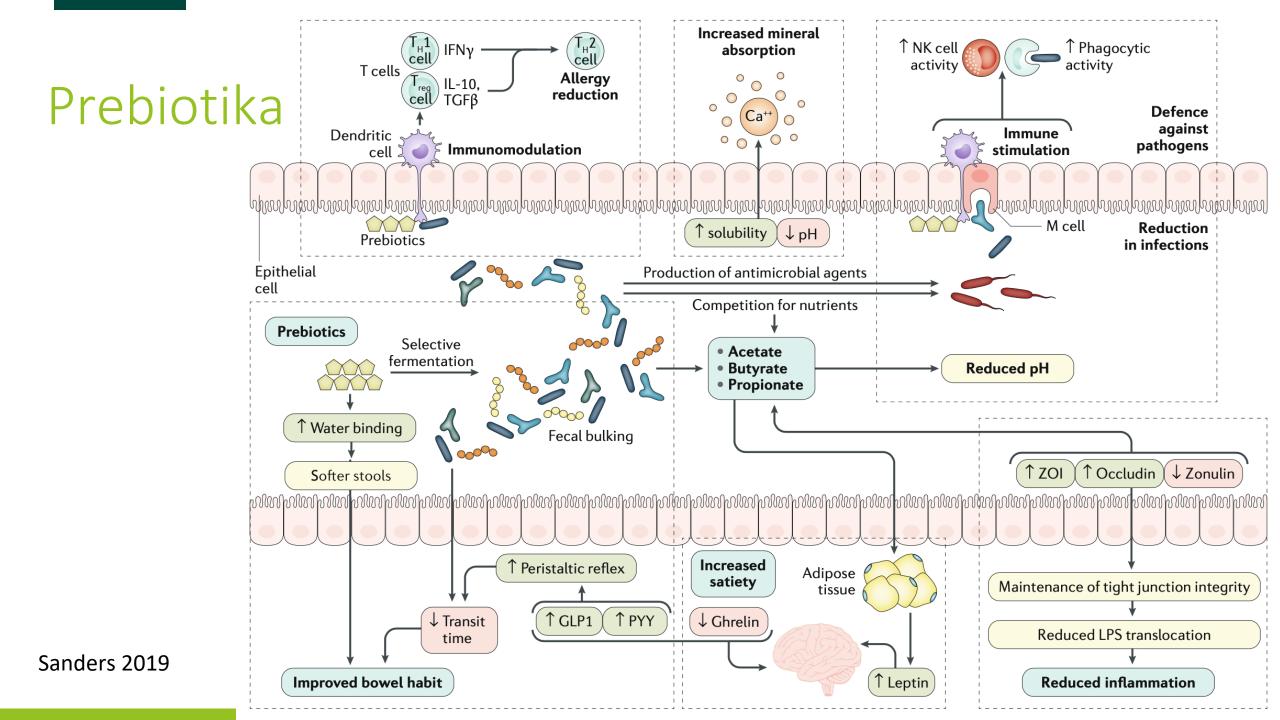
Conclusion

The use of olive oil and onion in Mediterranean cooking as a base for sauces and dishes, with an appropriate cooking time, preserve the polyphenol content of food. Thus, Mediterranean cuisine may contribute to the health effects of the Mediterranean diet. © 2019 Society of Chemical Industry

Probiotika

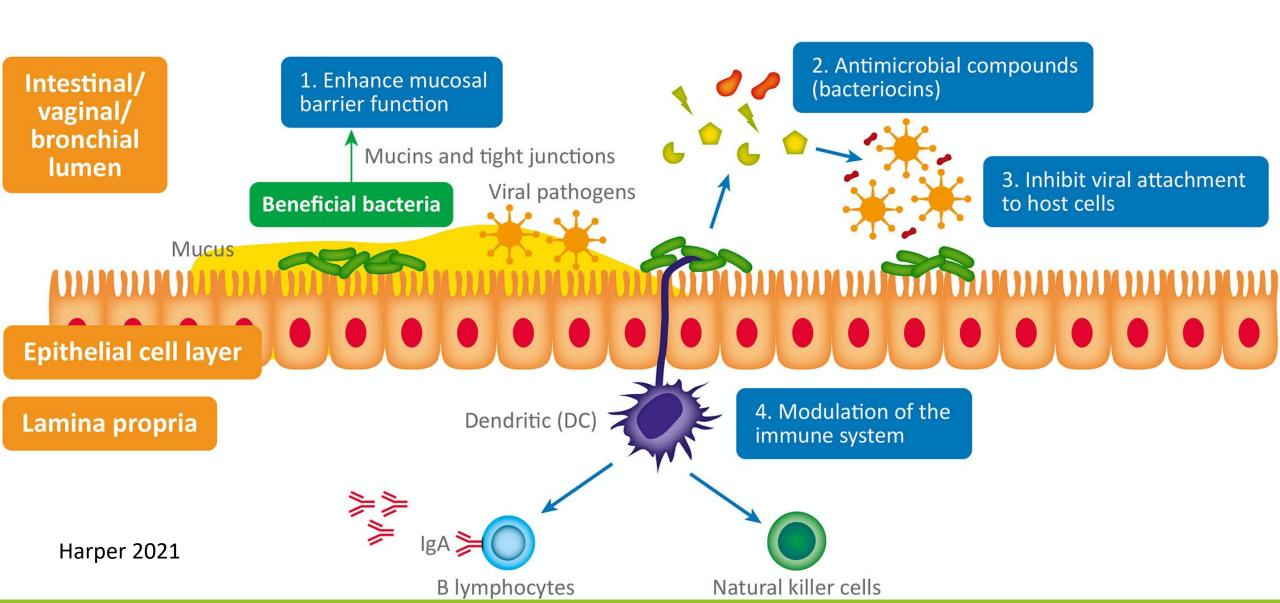


Sanders 2019



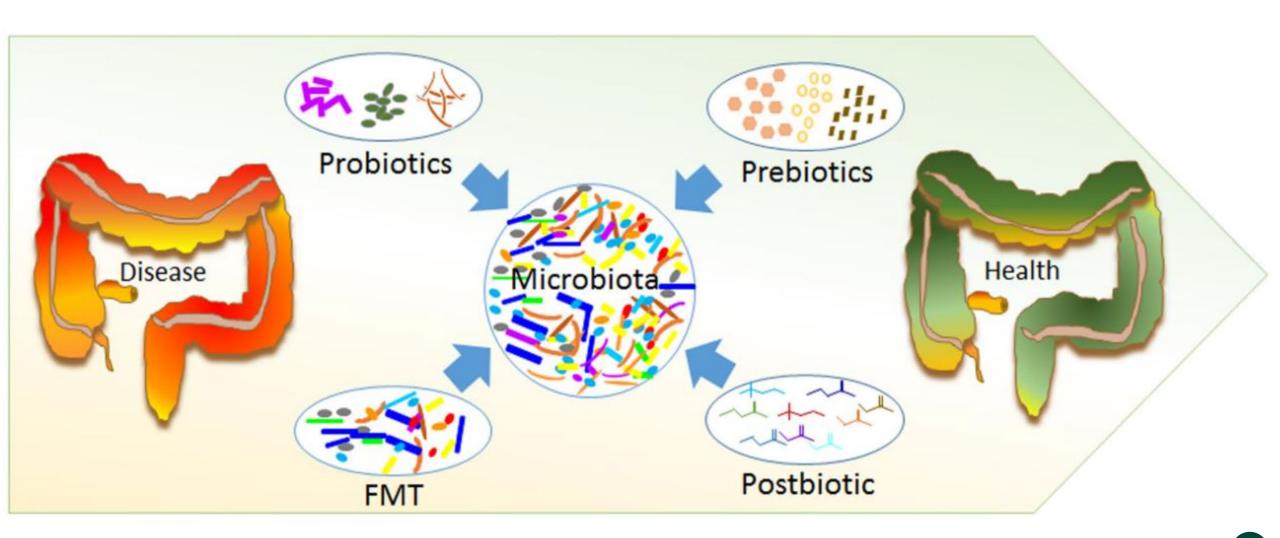
Probiotika: auch antiviral







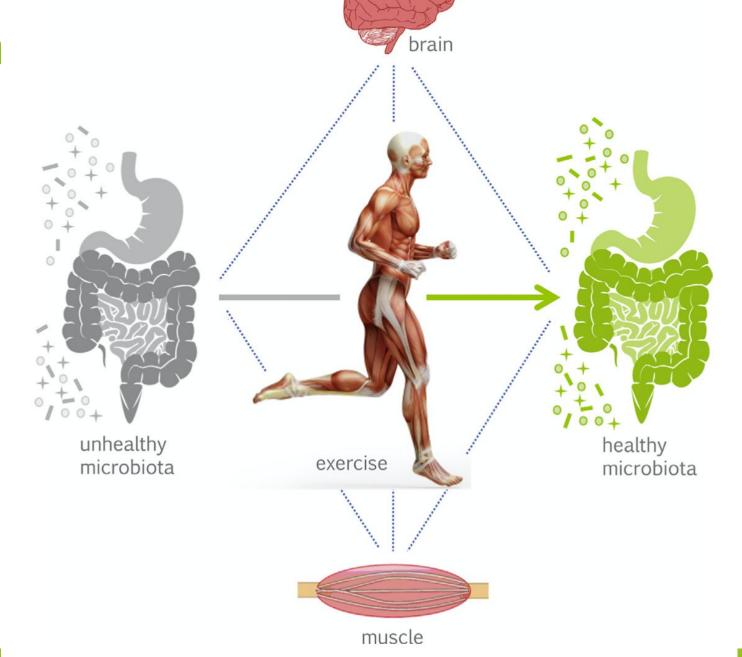
Kombination und Priorität



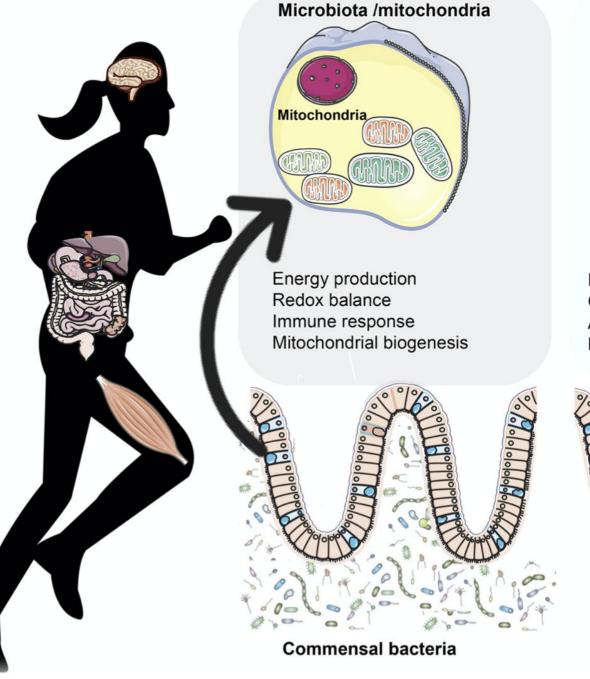
Vernocchi 2020

Bewegen

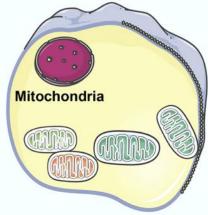




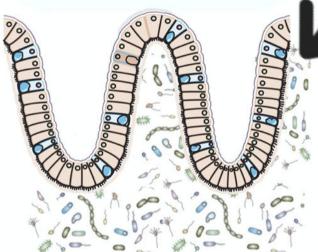
Mitochondrien und Mikrobiom



Mitochondria /microbiota



Redox balance Control pathogens Activation of inflammasomes Maintain gut barrier integrity



Commensal bacteria

Clark 2017

Entspannung

The brain to influence the intestinal microbiota



Meditation



Brain

Perturbation of normal habitate via stress-induced changes in gastrointestinal:

- (i) Physiology
- (ii) Epithelial function
- (iii) Mucin production
- (iv) Entero-endocrine cell function
- (v) Motility Release of neurotransmitters

Activation of neural afferent circuits to the brain

Activation of mucisal immune responses

Production of metabolites that directly influence the central nervous system

The microbiota to influence the brain and behavior





Gut microbiota



Zusammenfassung

- Faserstoffreiche Nahrung
- Nahrung reich an sekundären Pflanzenstoffen
- Probiotika
- Prebiotika
- Bewegung
- Entspannung

Mögliches Protokoll?



Schritt 1: Entzündung senken, falls nötig (Omega-3 FS, Phytotherapeutika, ggf. auch Antibiotika)

Schritt 2: Barriere reparieren, falls nötig (Vit D, Glutamin, Zink, Ribose)

Schritt 3: Mikroflora reparieren (Pro- und Prebiotika)

Schritt 4: ggf. Immunsystem modulieren (Probiotika, Omega-3 FS, Glykane, Bewegung)

Schritt 5: Mikroflora stabilisieren 1 (Prebiotika, Bewegung)

Schritt 6: Mikroflora stabilisieren 2 (hohe Nährstoffvariabilität, Bewegung)



Vielen Dank für die Aufmerksamkeit





Bedankt