

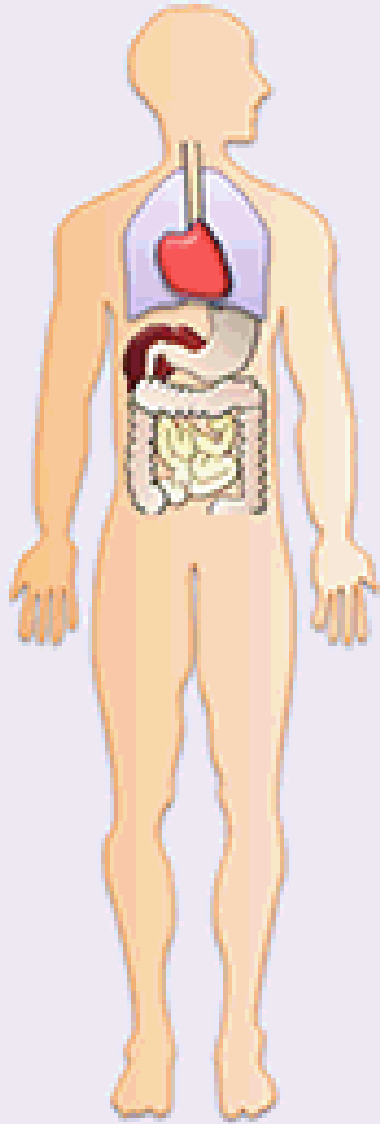
# Das menschliche Mikrobiom

Mehr, als wir erwartet haben

**Tom Fox**

08.10.2021

## Visible Organs



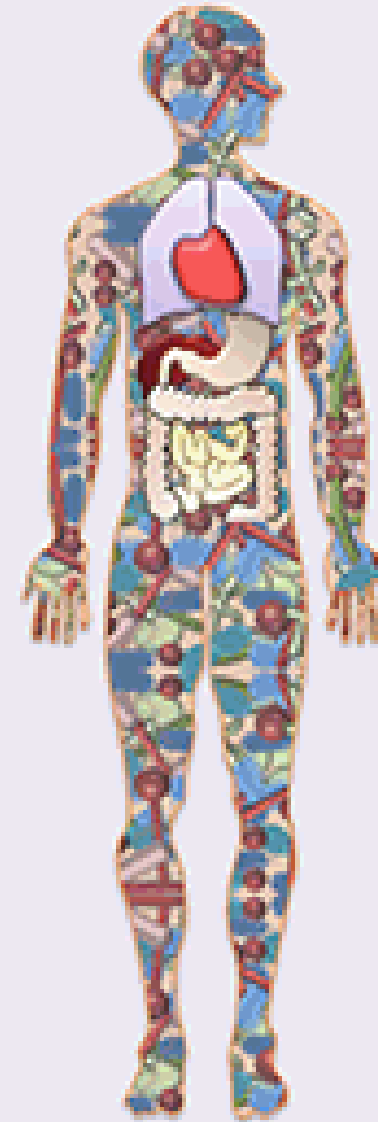
- ▶  $\sim 10^{14}$  cells
- ▶  $\sim 23000$  genes

## Invisible Microbiome



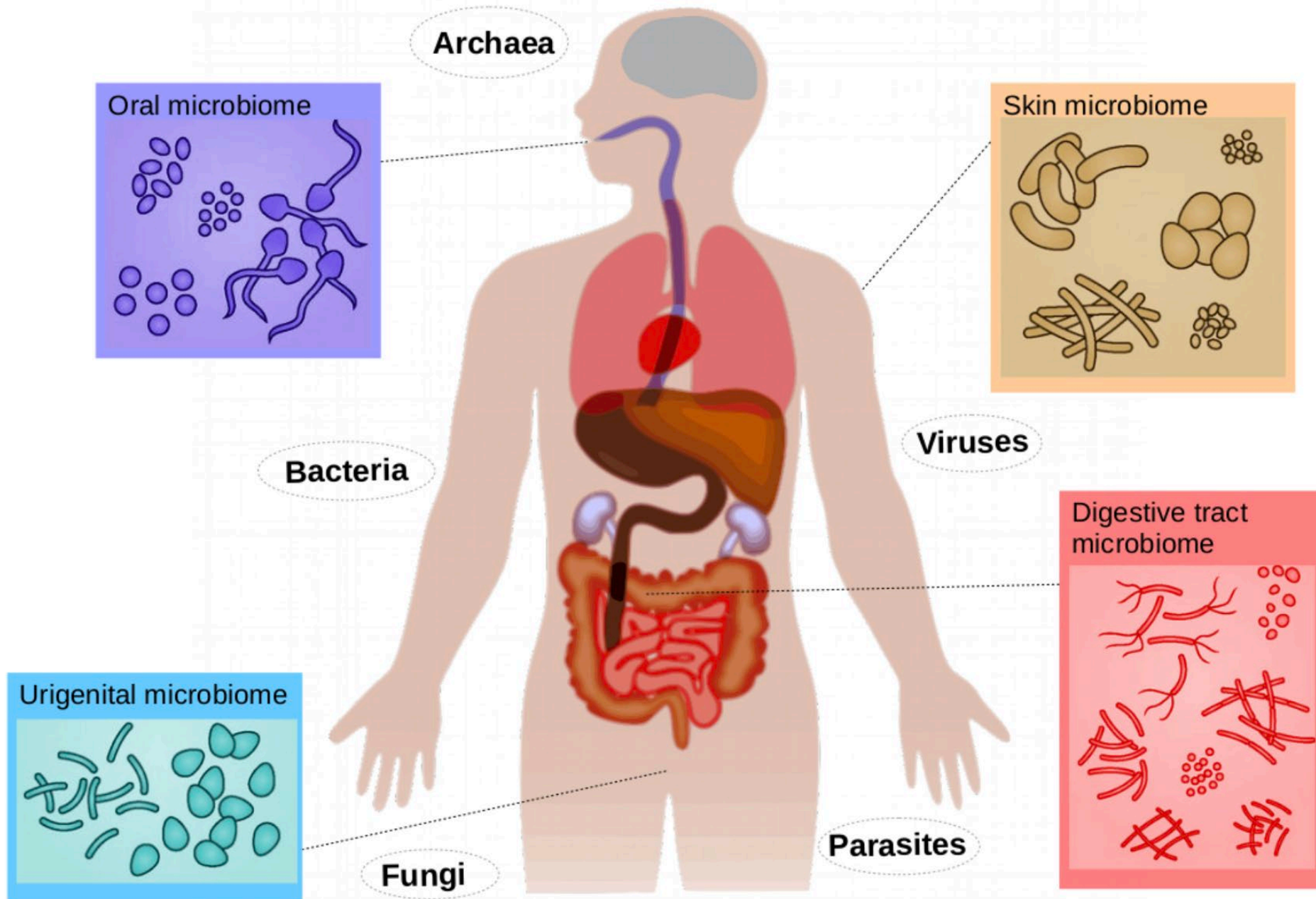
- ▶  $\sim 10^{14}$  million microbes
- ▶  $\sim 9$  million genes

## Complete Human

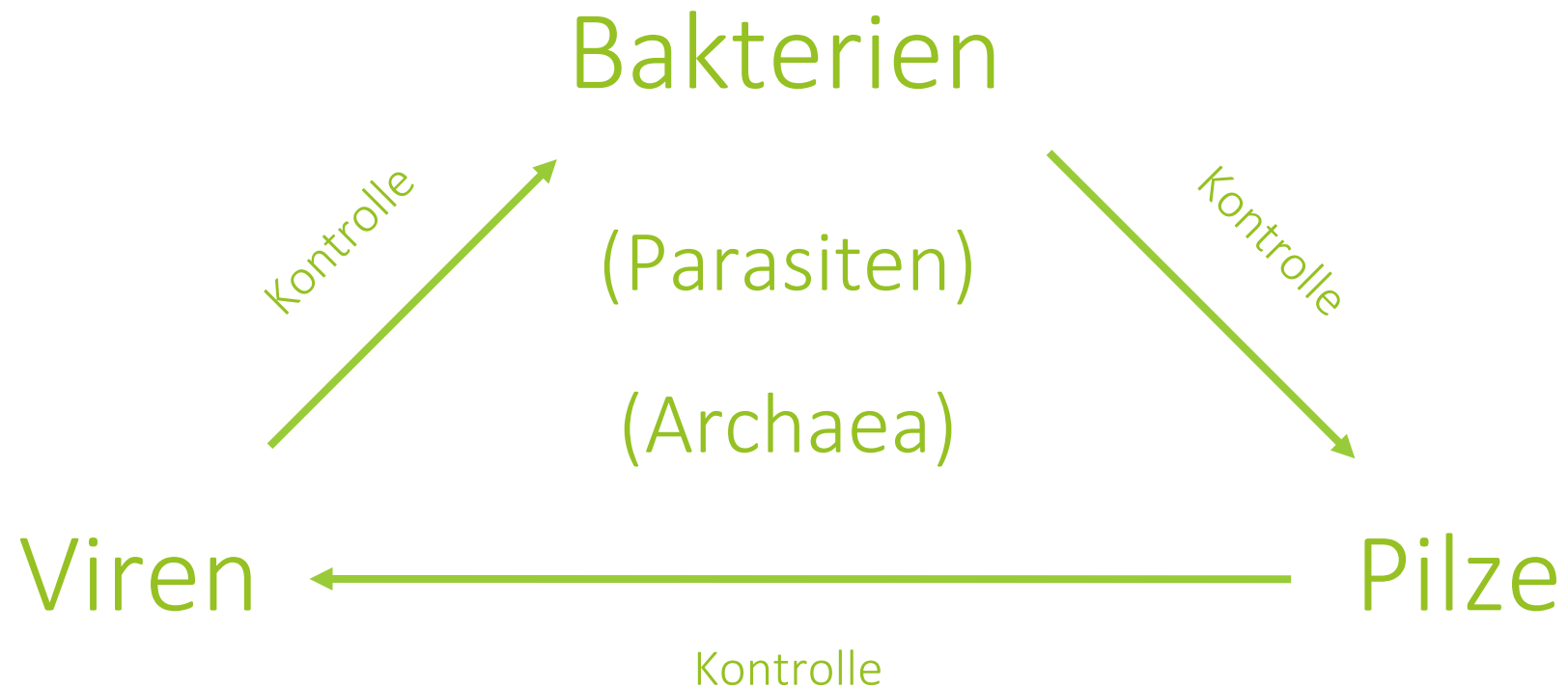


Normal functioning body

# 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

Ernährung

Bewegung

Stress

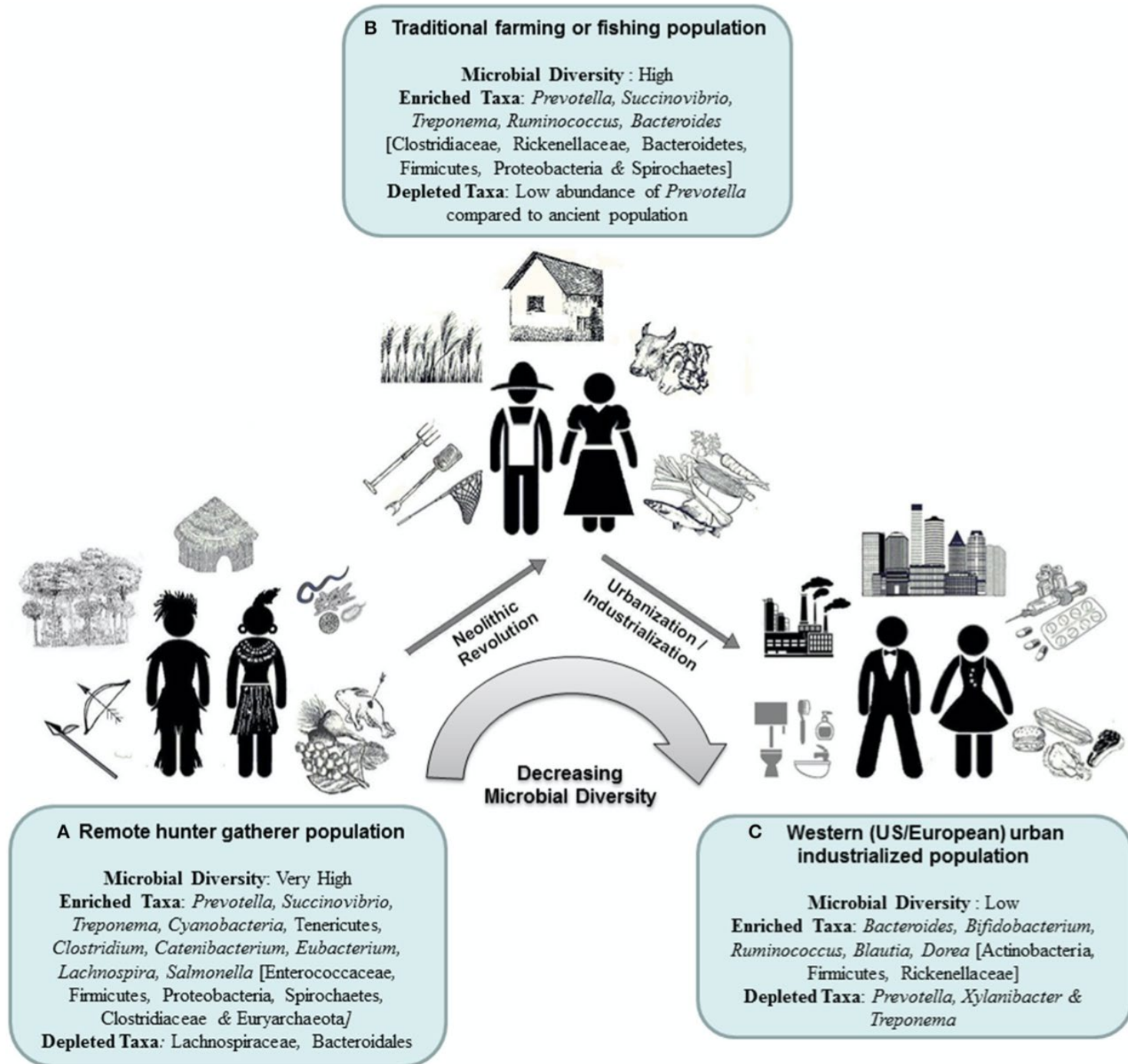
Konsequenzen



An artistic illustration of a microbiome. The background is a dark blue, textured surface composed of many small, rounded, pebbly structures, possibly representing cells or a mucosal lining. Scattered throughout this field are numerous small, green, rod-shaped bacteria, some appearing to be in motion or interacting with the surface. The lighting is soft and focused, creating a sense of depth and highlighting the individual bacterial forms.

# Wie steht es um unser Mikrobiom?

# Mehr Fortschritt - weniger Diversität



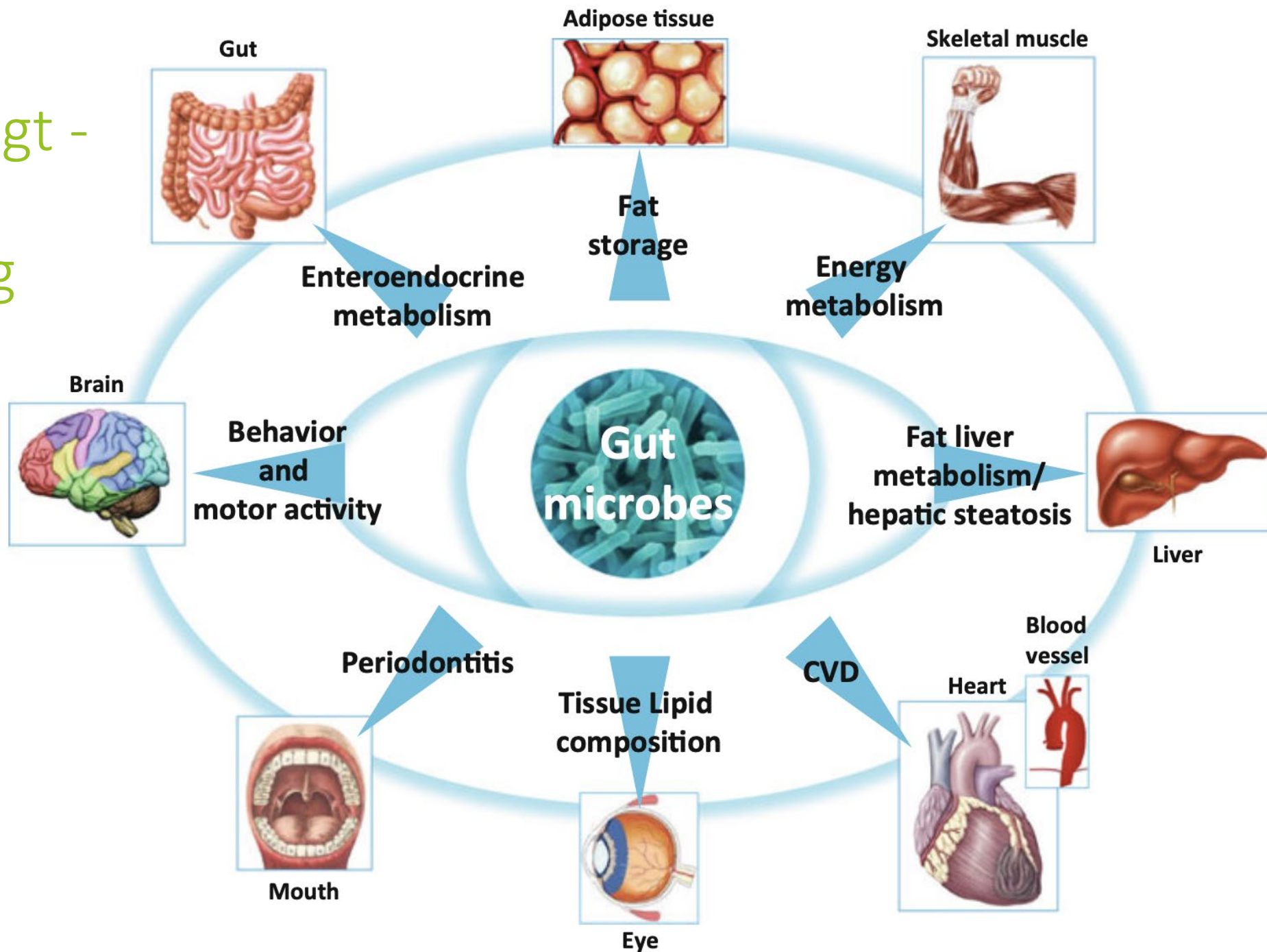
## Und warum? Beispiele ...

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

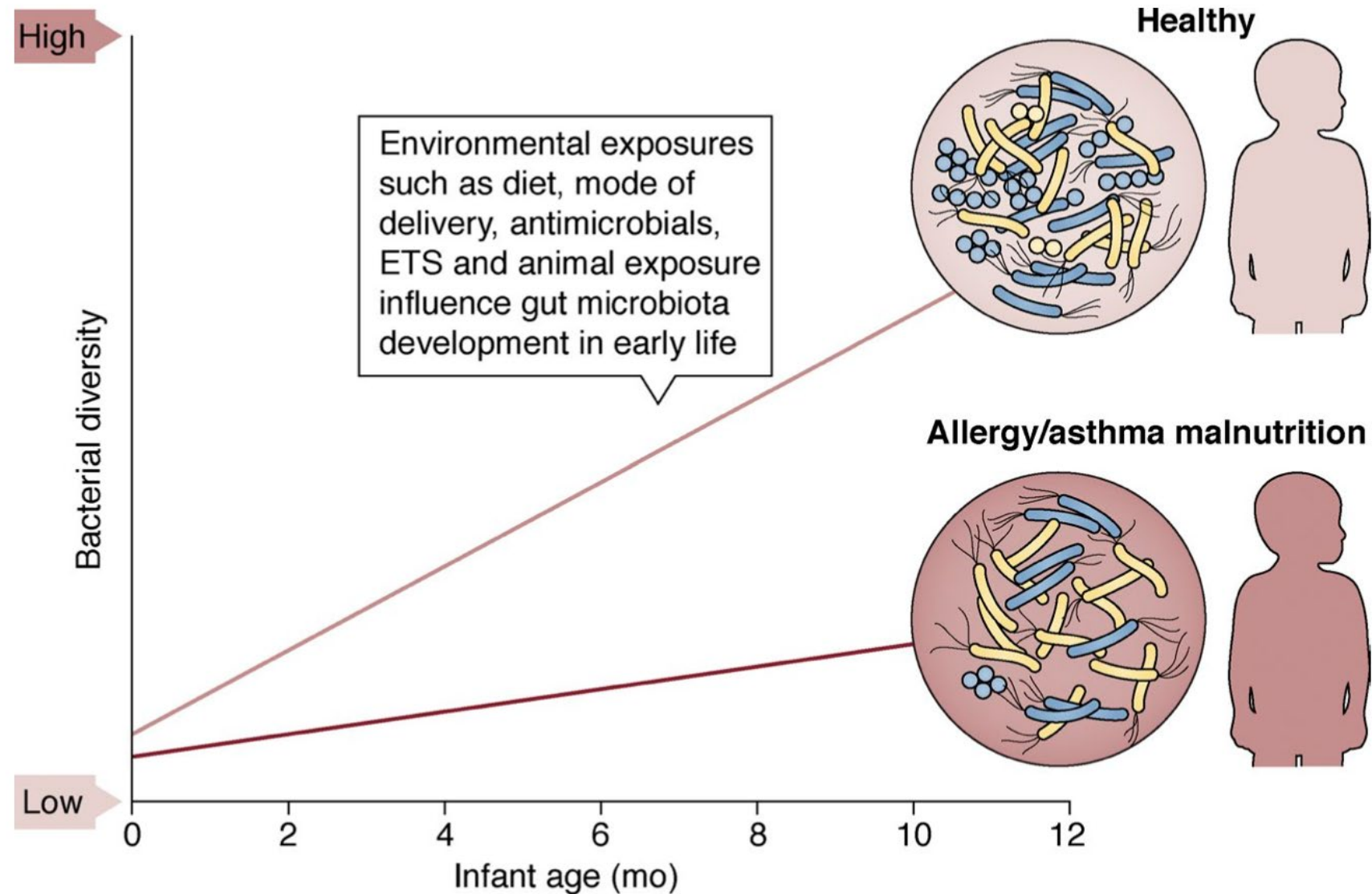
# Mikrobiom: die klassische Sichtweise

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

Wie gesagt -  
ein wenig  
mehr ...

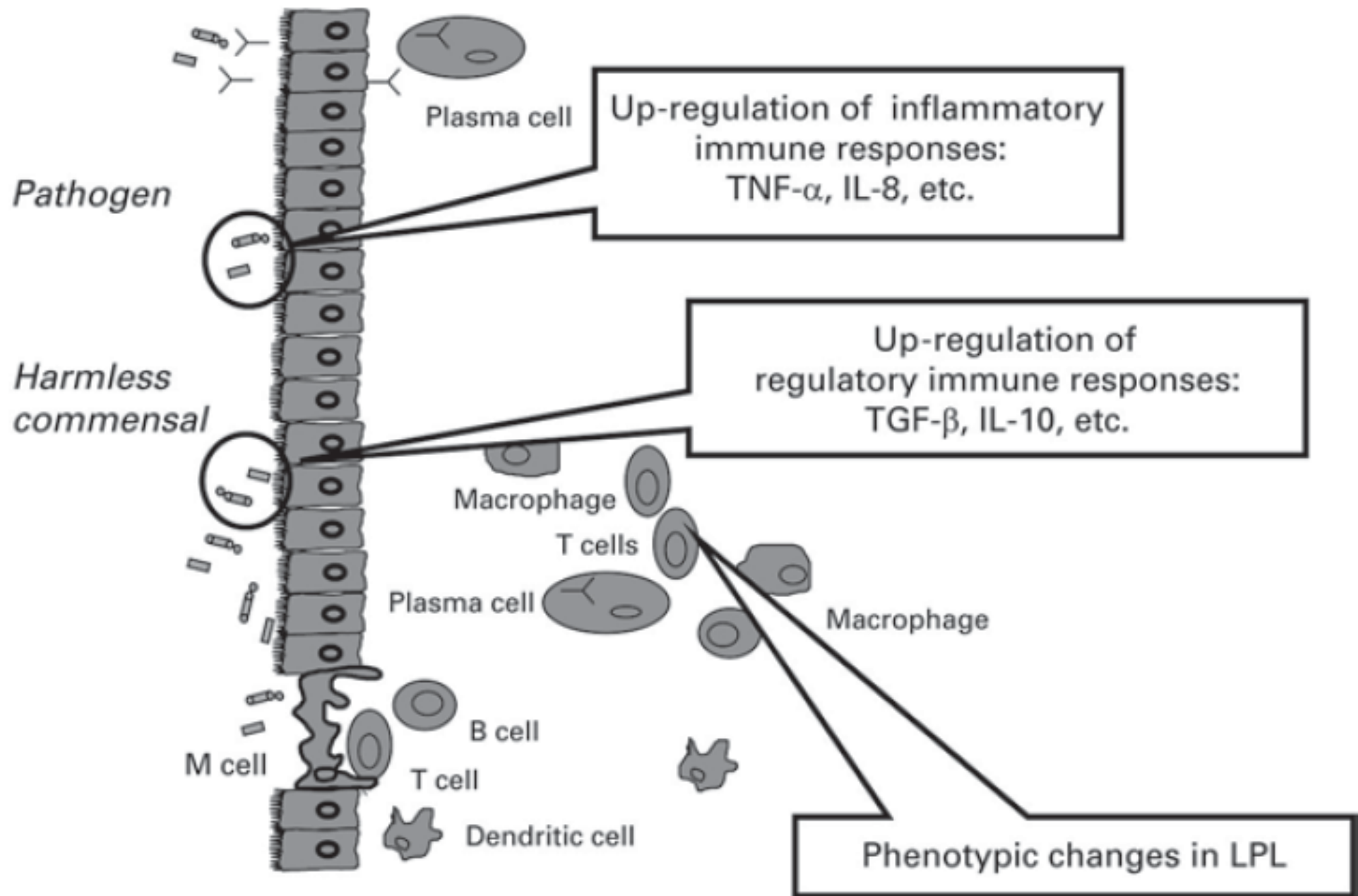


... und es beginnt  
früh zu arbeiten



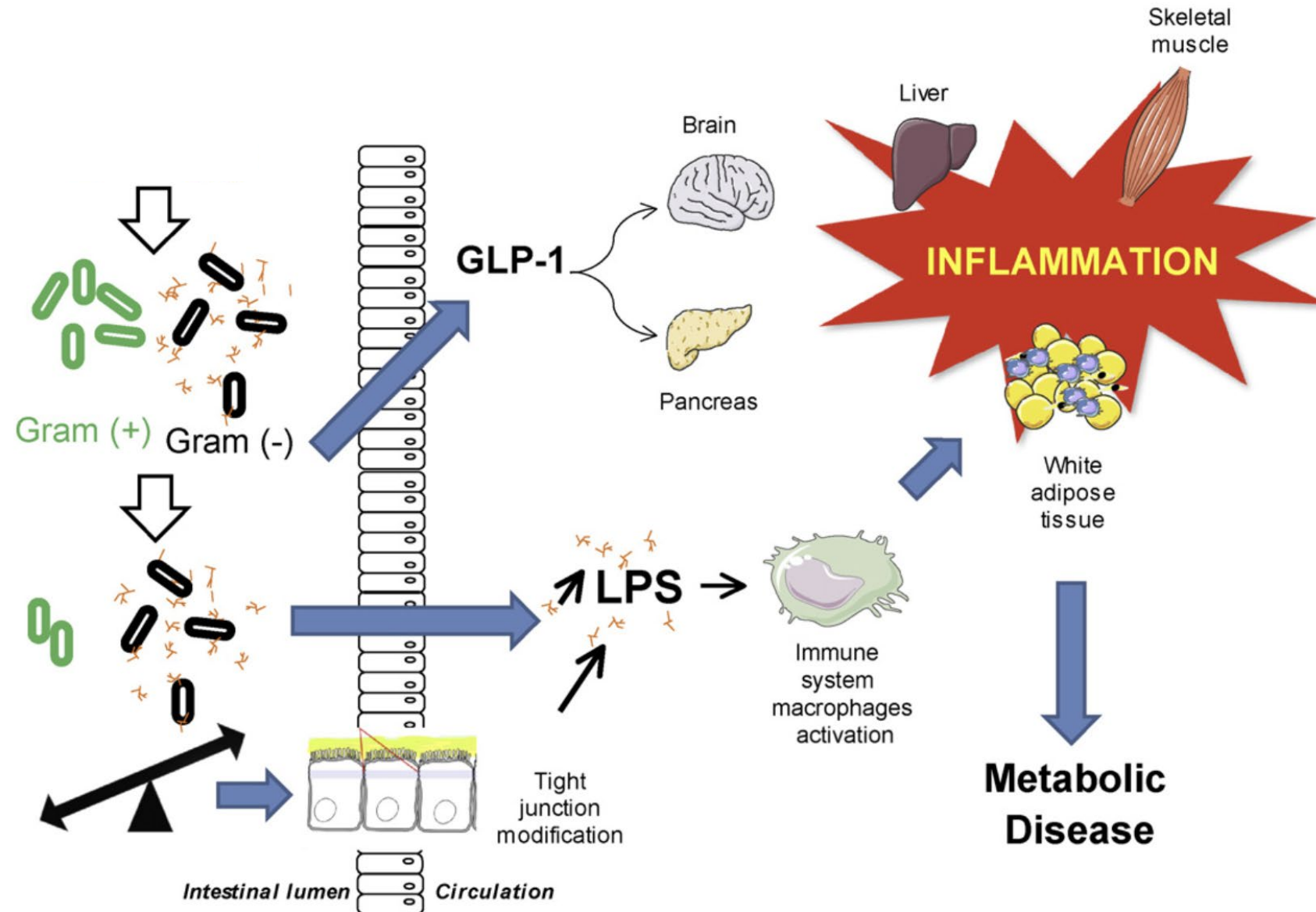
Folgen / Konsequenzen eines  
gestörten Mikrobioms

# Wichtig für unser Immunsystem

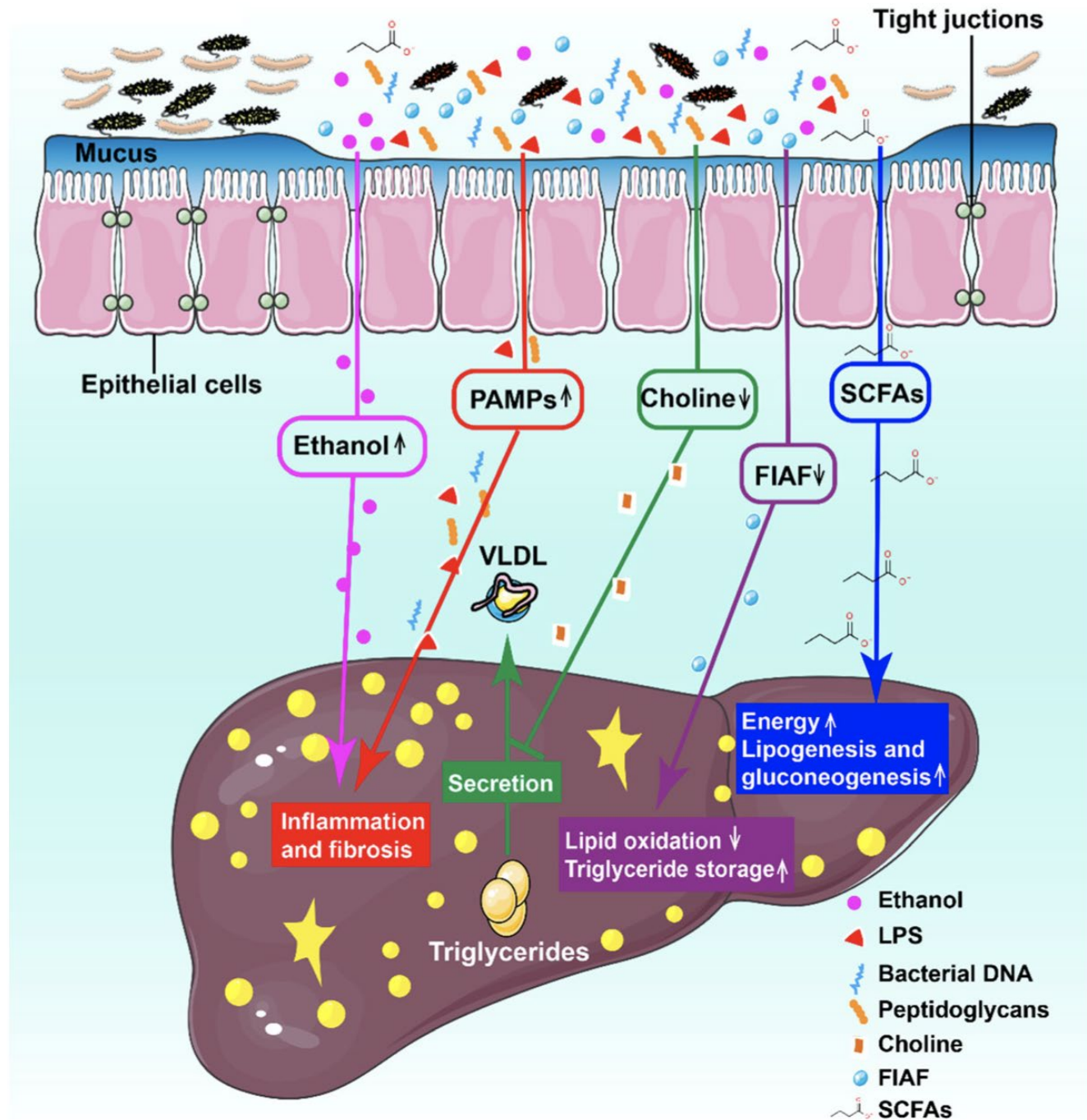




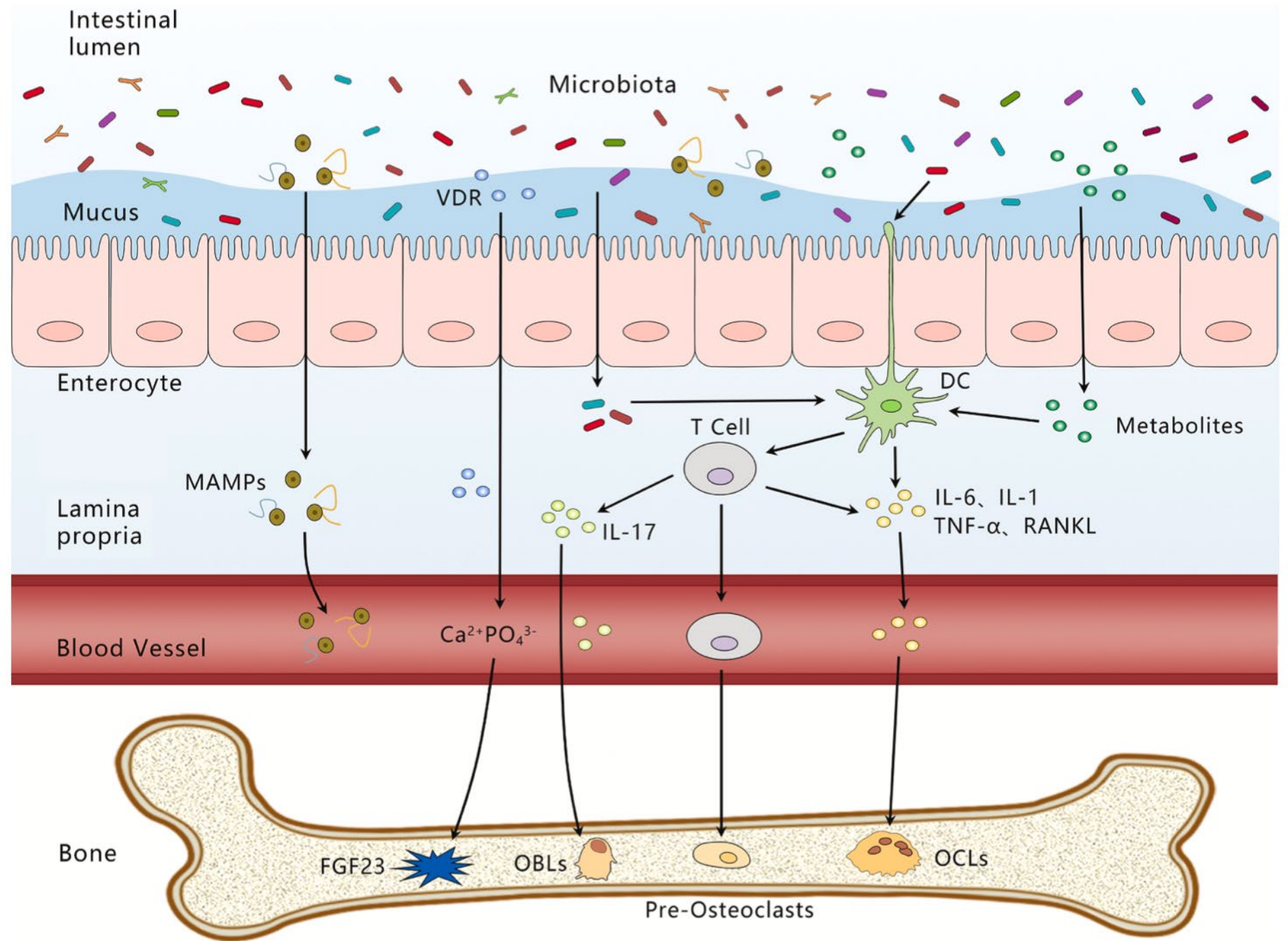
# Falsche Flora = Stoffwechselprobleme



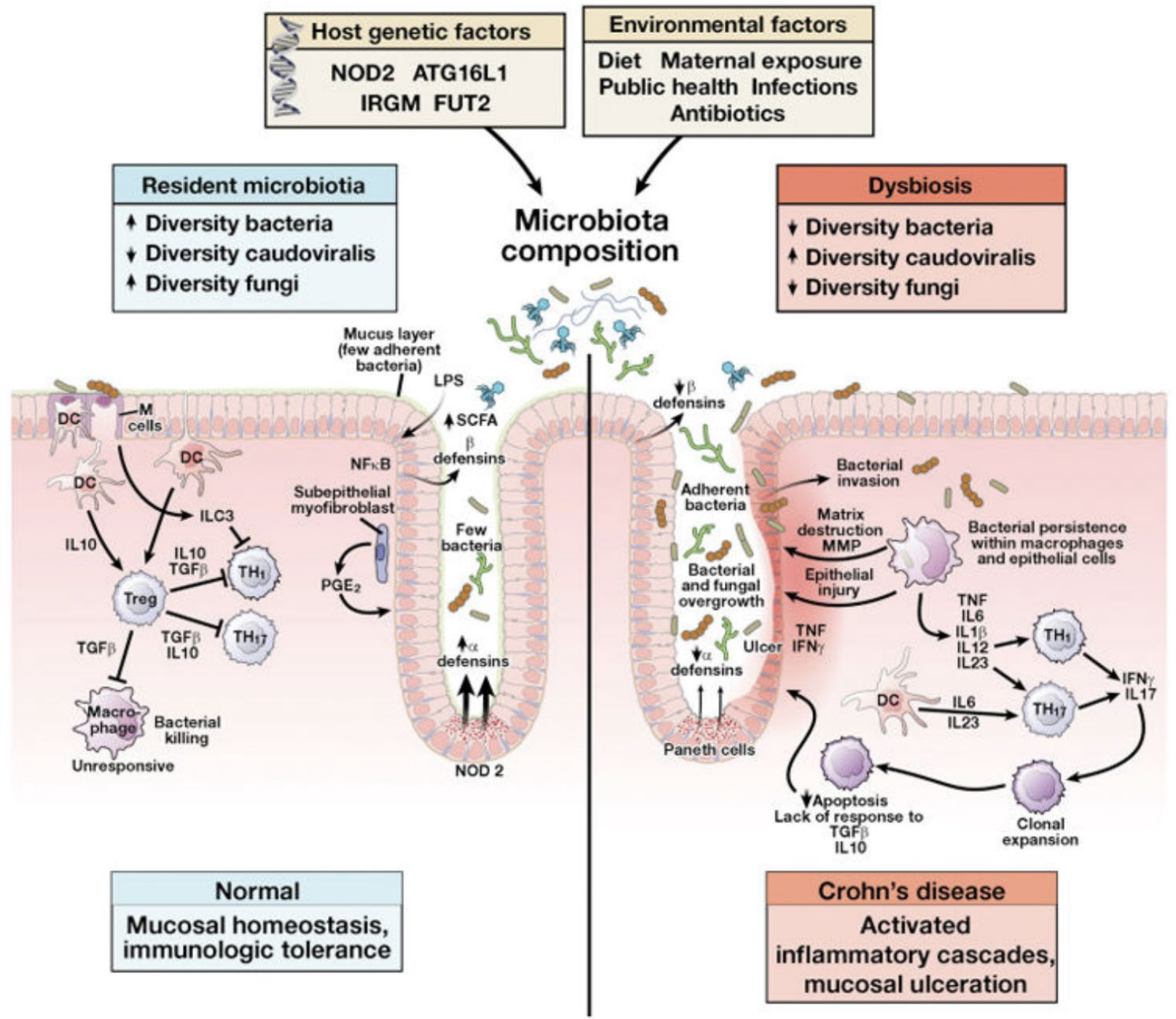
# Mikrobiom und NAFLD



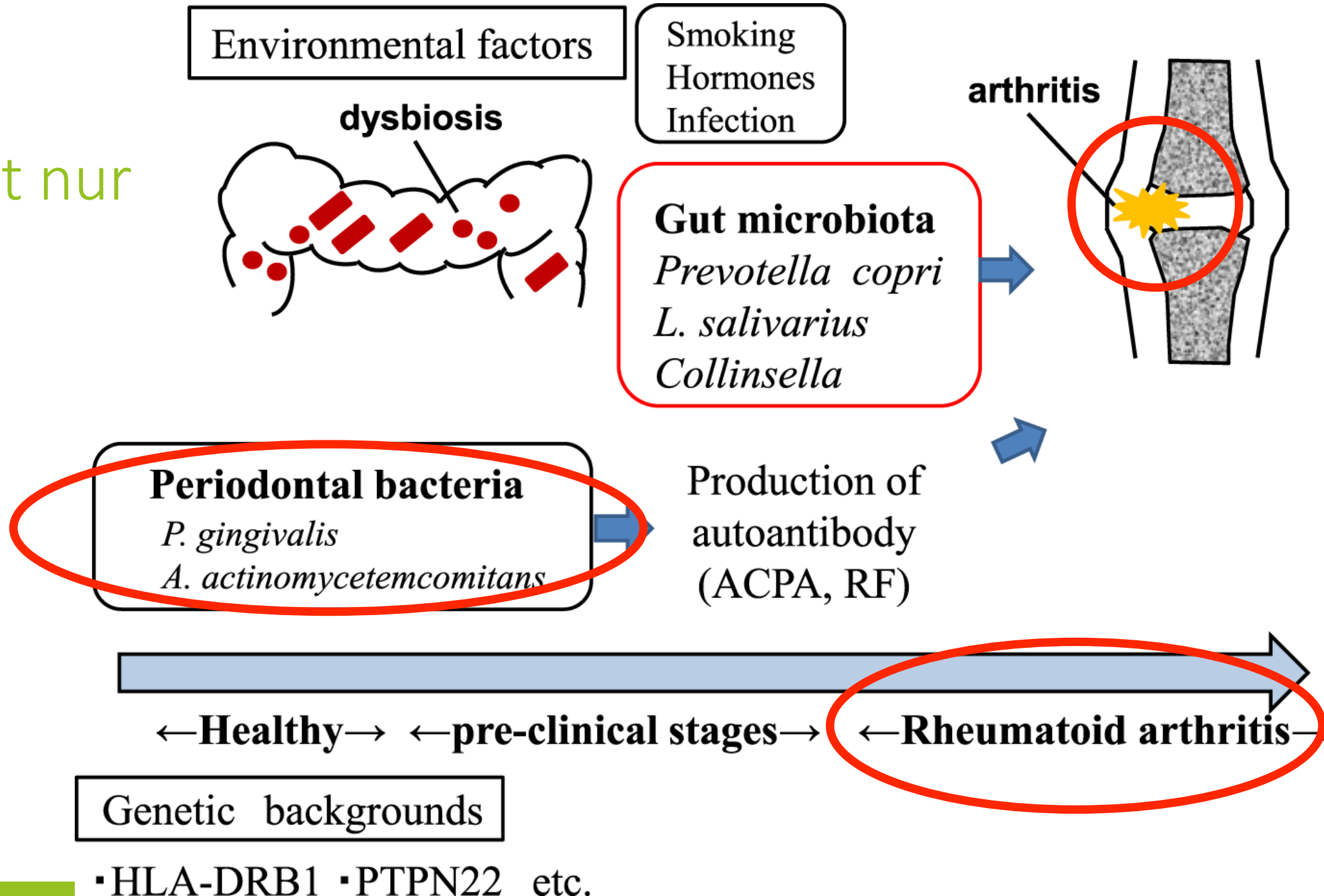
# Mikrobiom und Knochen



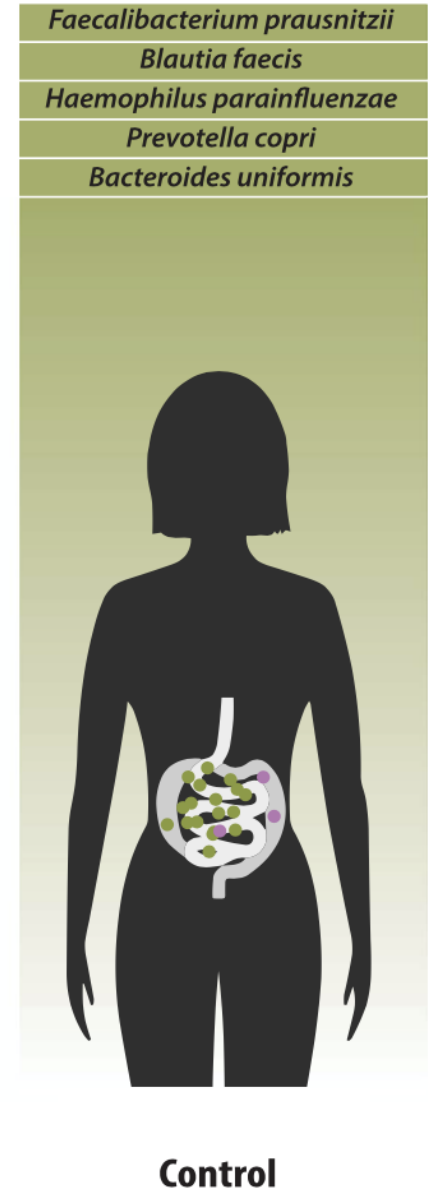
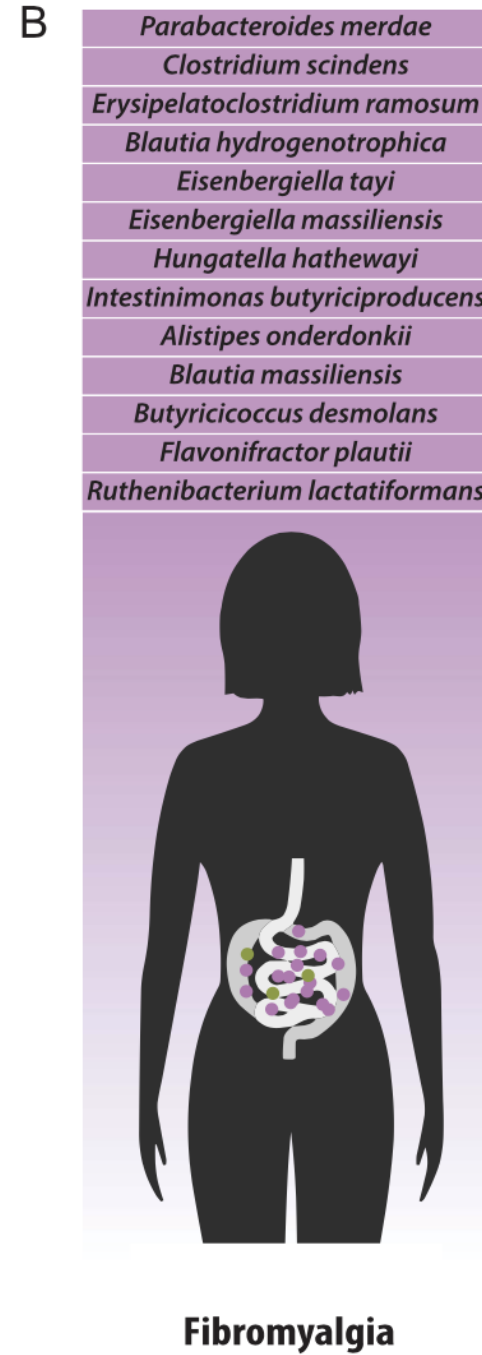
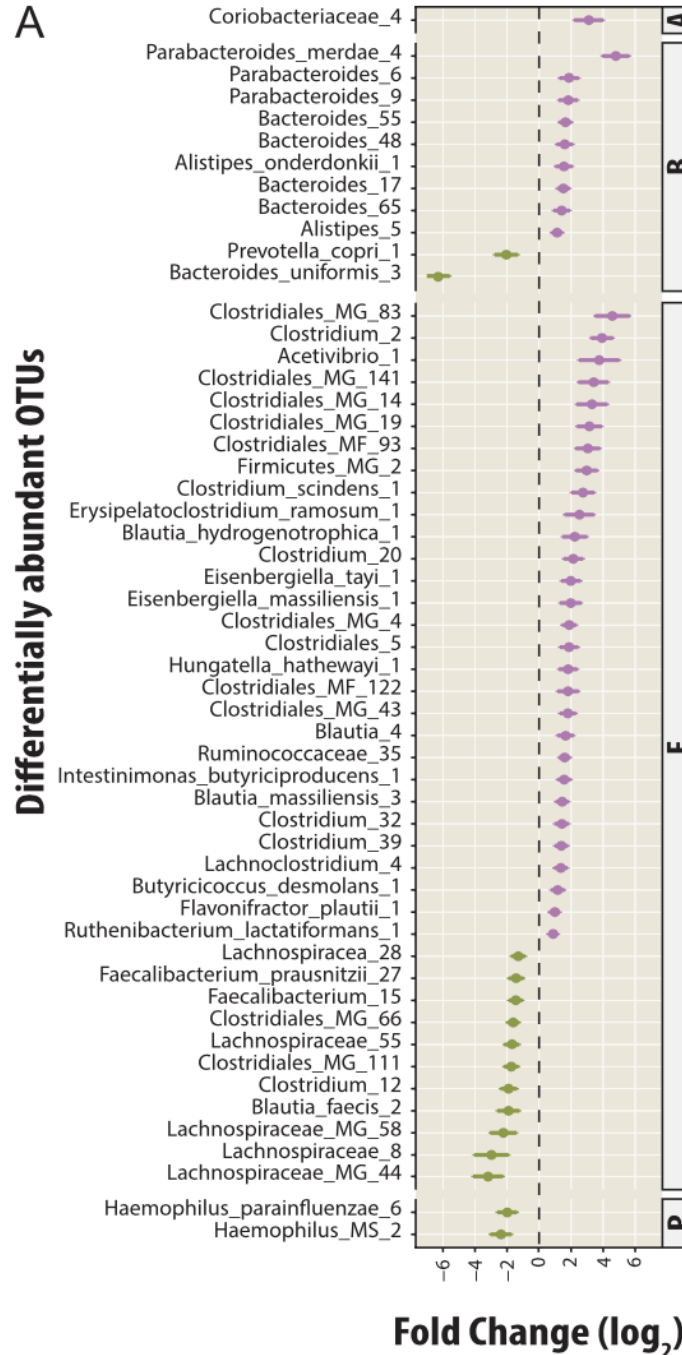
Und leider auch „Entzündung“



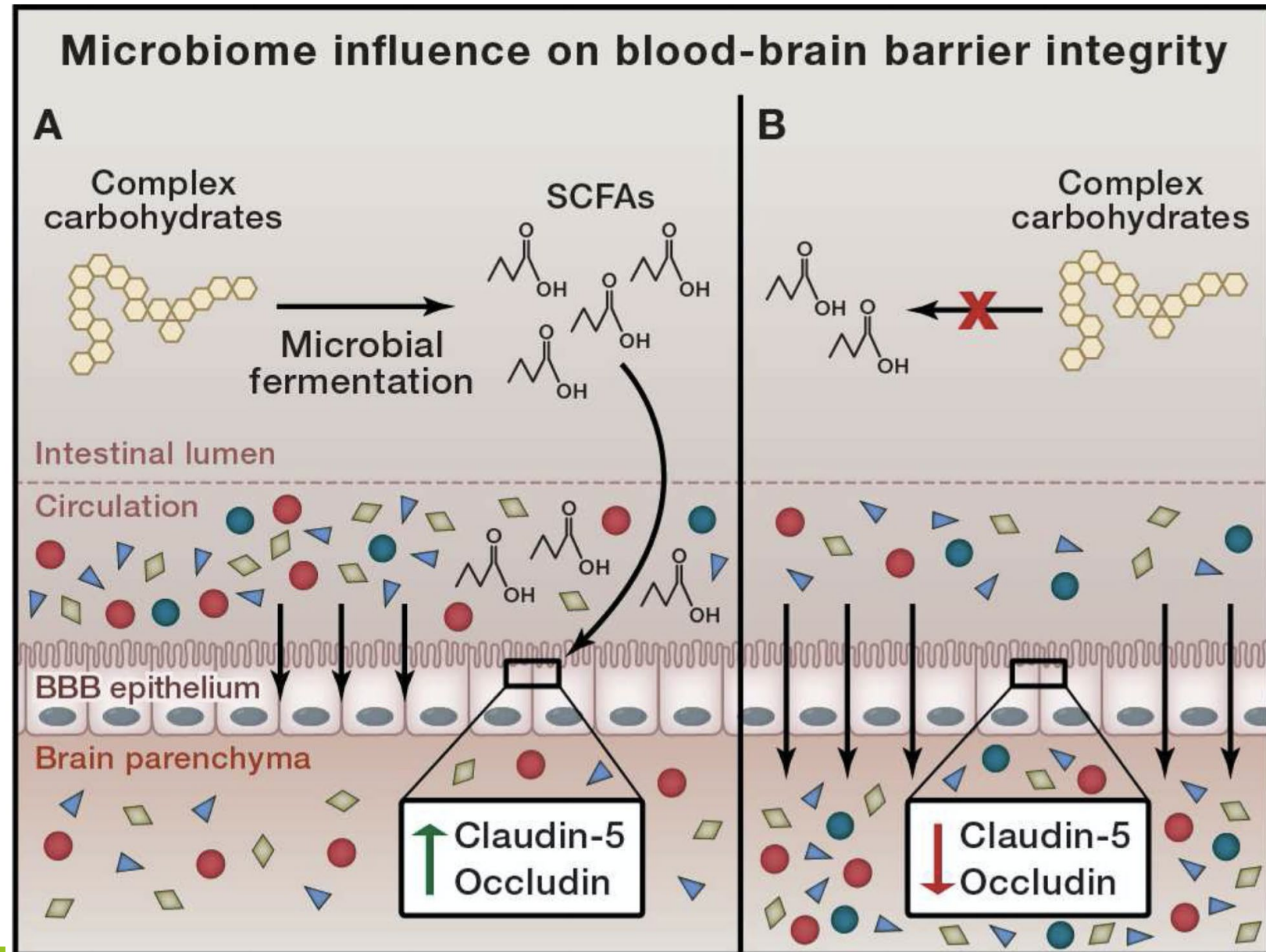
... und dies nicht nur im Darm



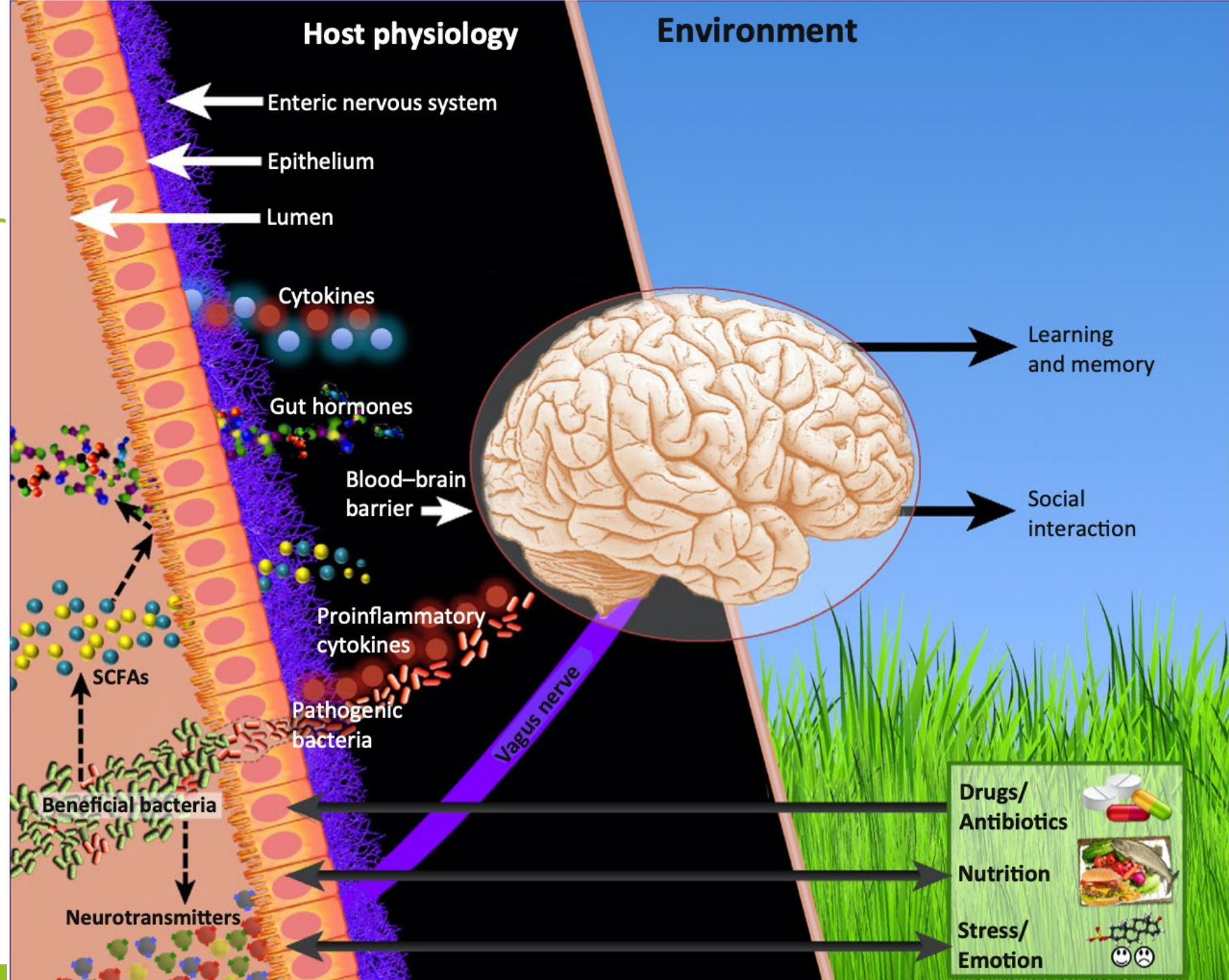
# Darmflora und Fibromyalgie



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

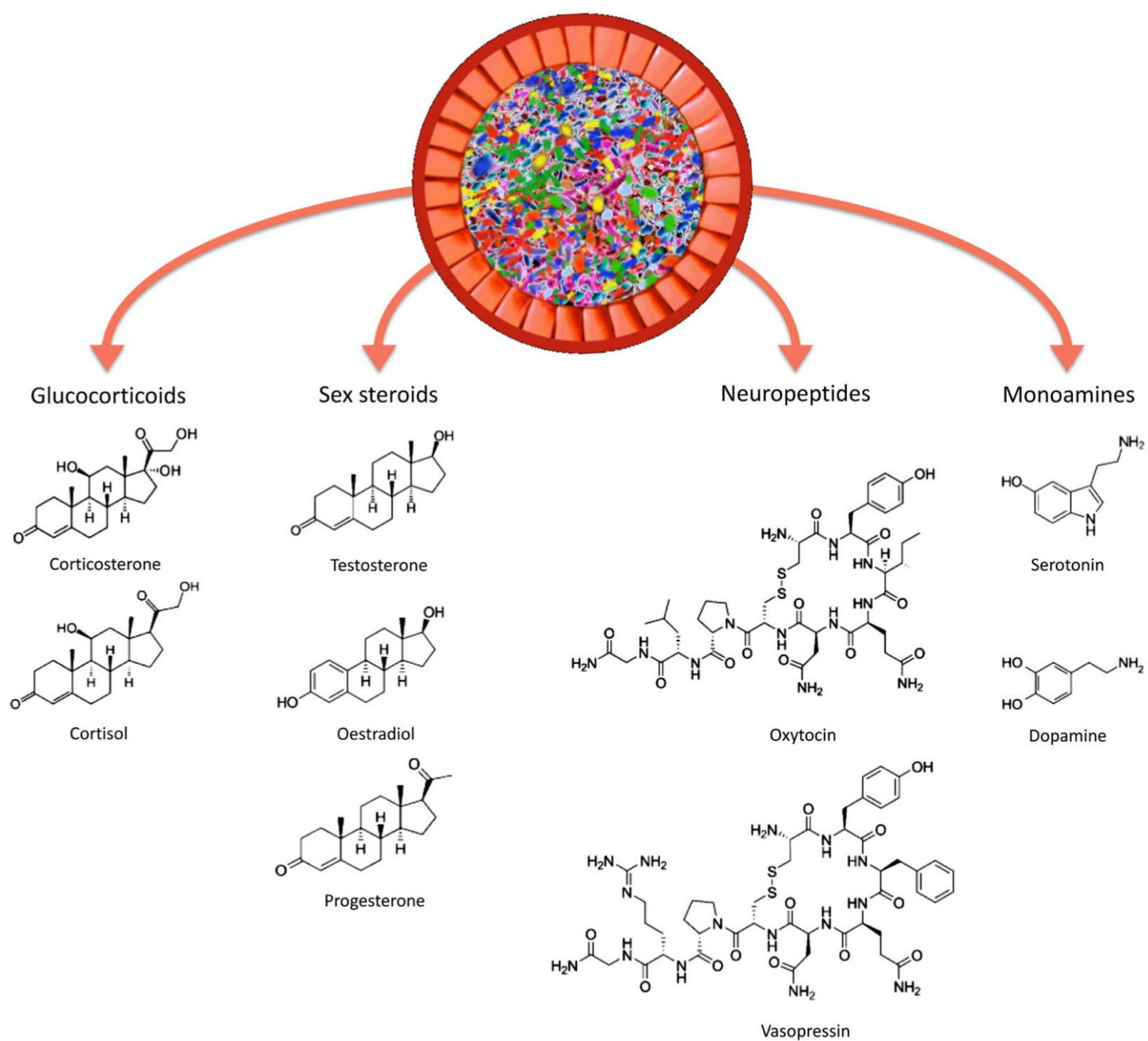


Somit sind  
Mikrobiom und  
Gehirn untrennbar  
verbunden

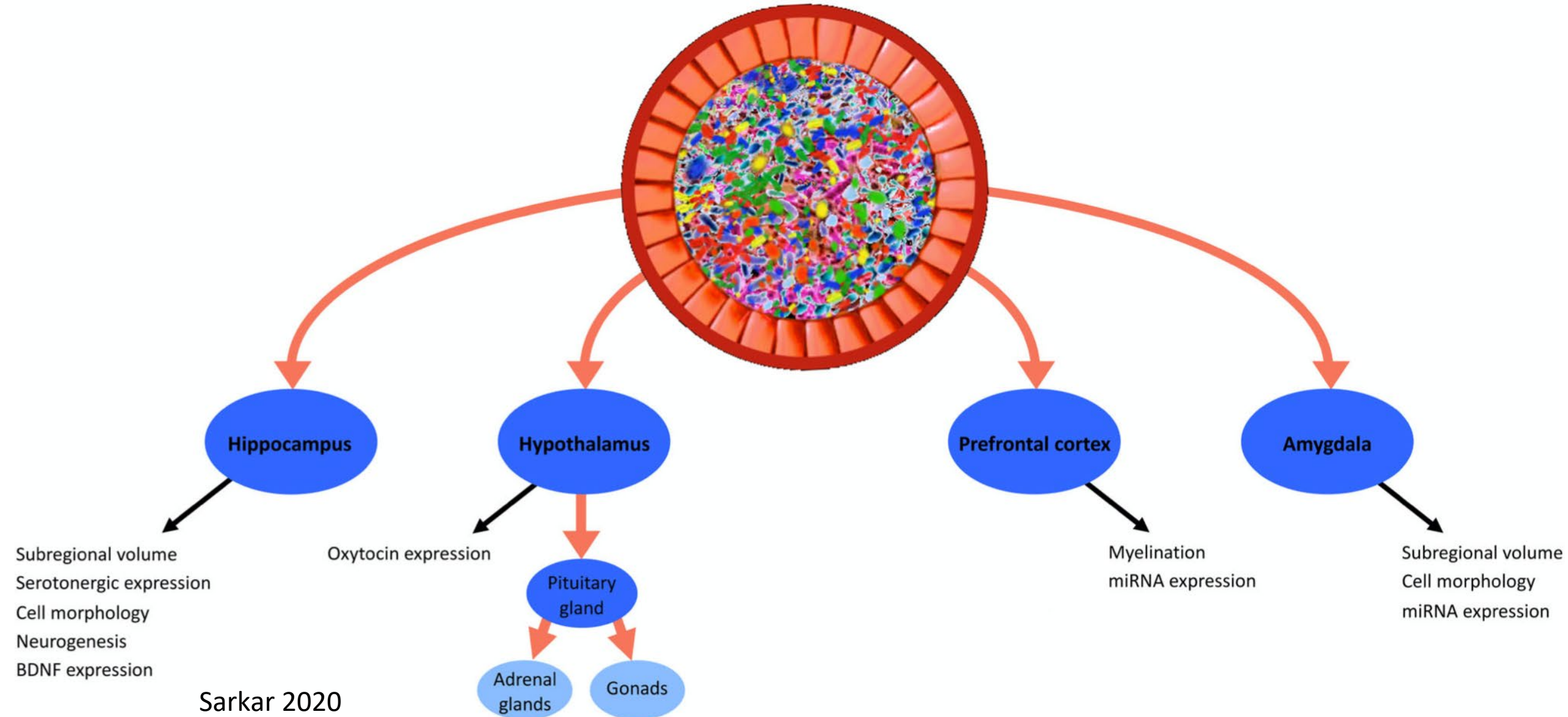




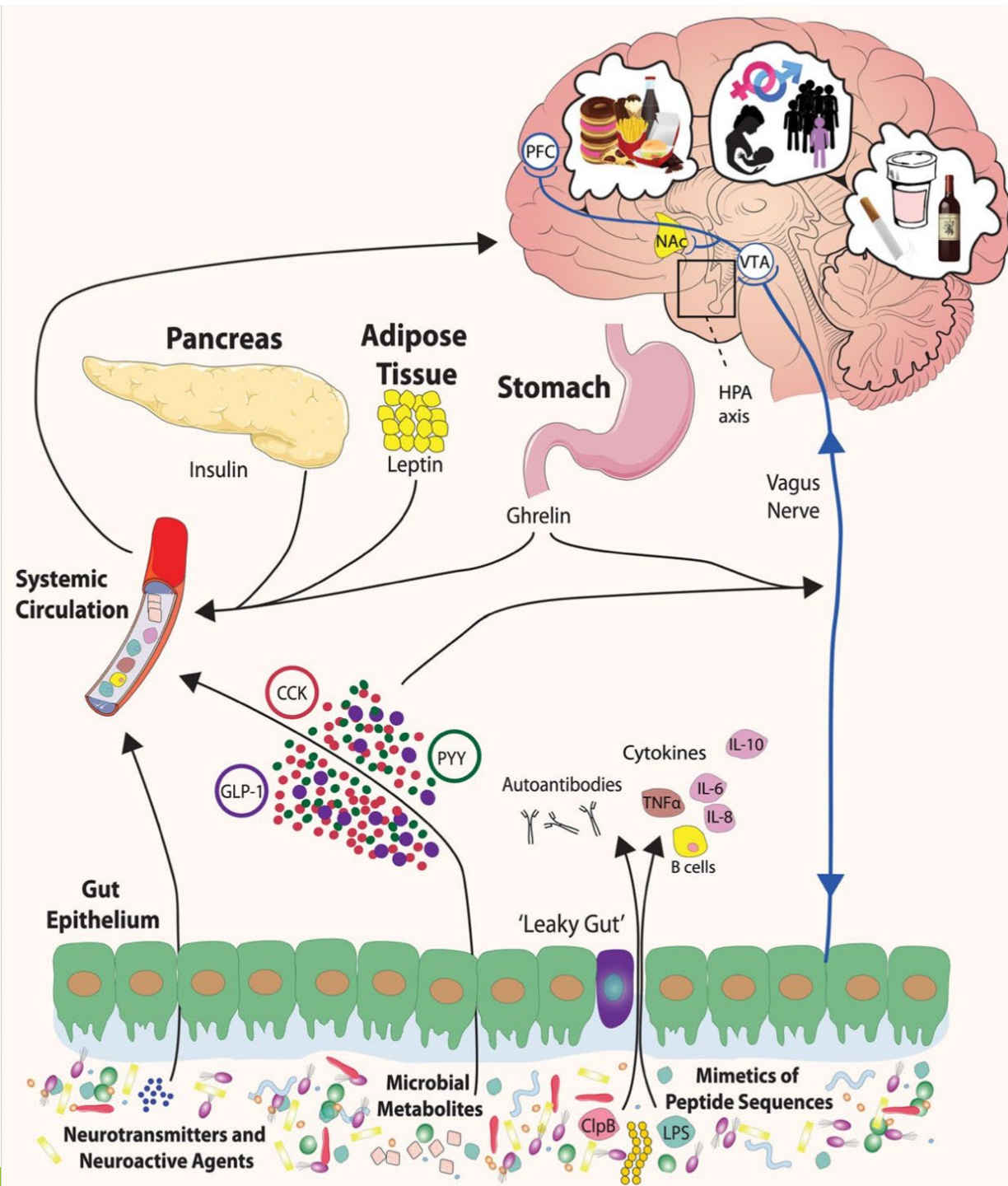
# Das Mikrobiom hat Einfluss auf Hormone und Botenstoffe



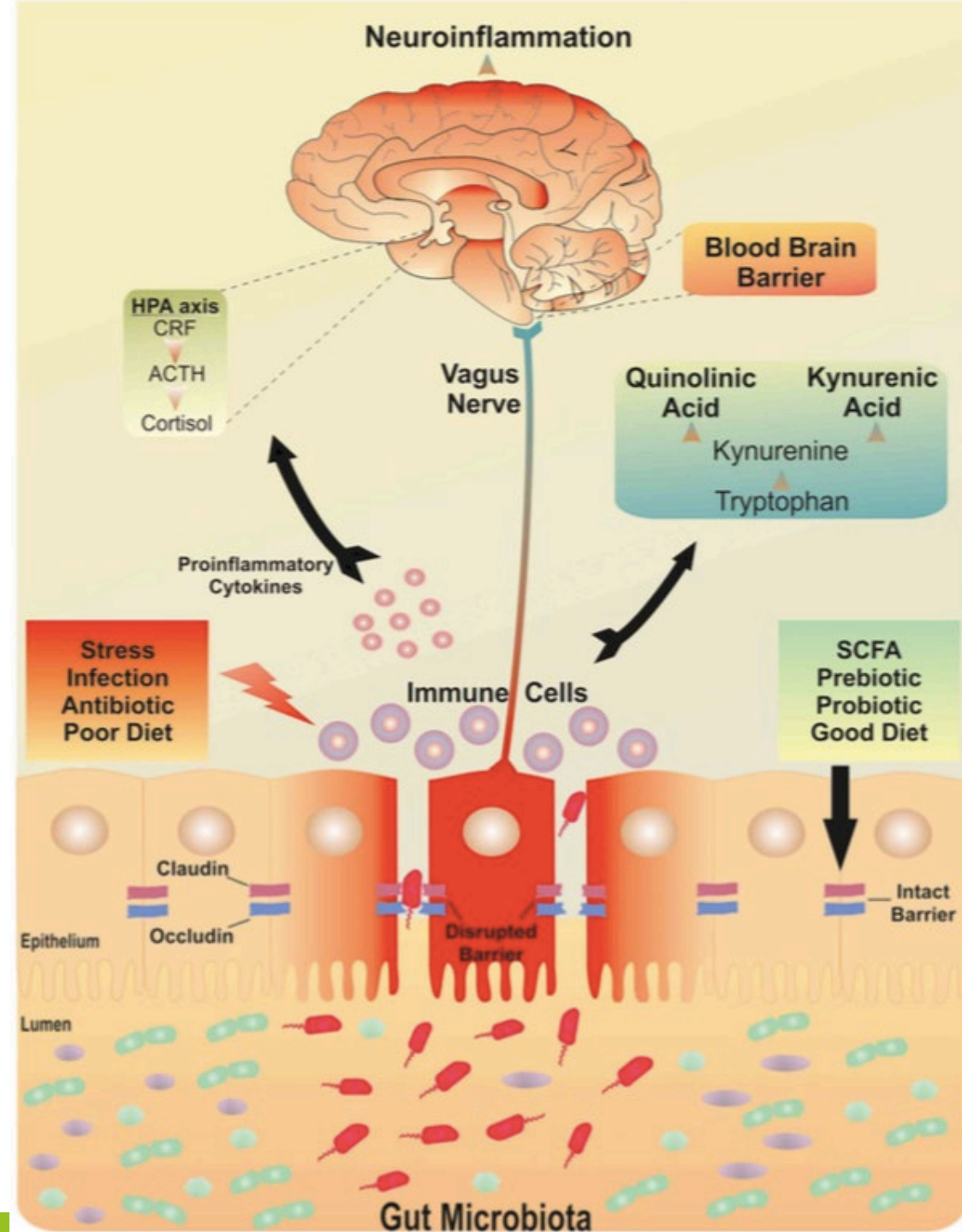
# Und auf die Gehirnaktivität



# Sogar „Belohnung“ ist abhängig vom Mikrobiom

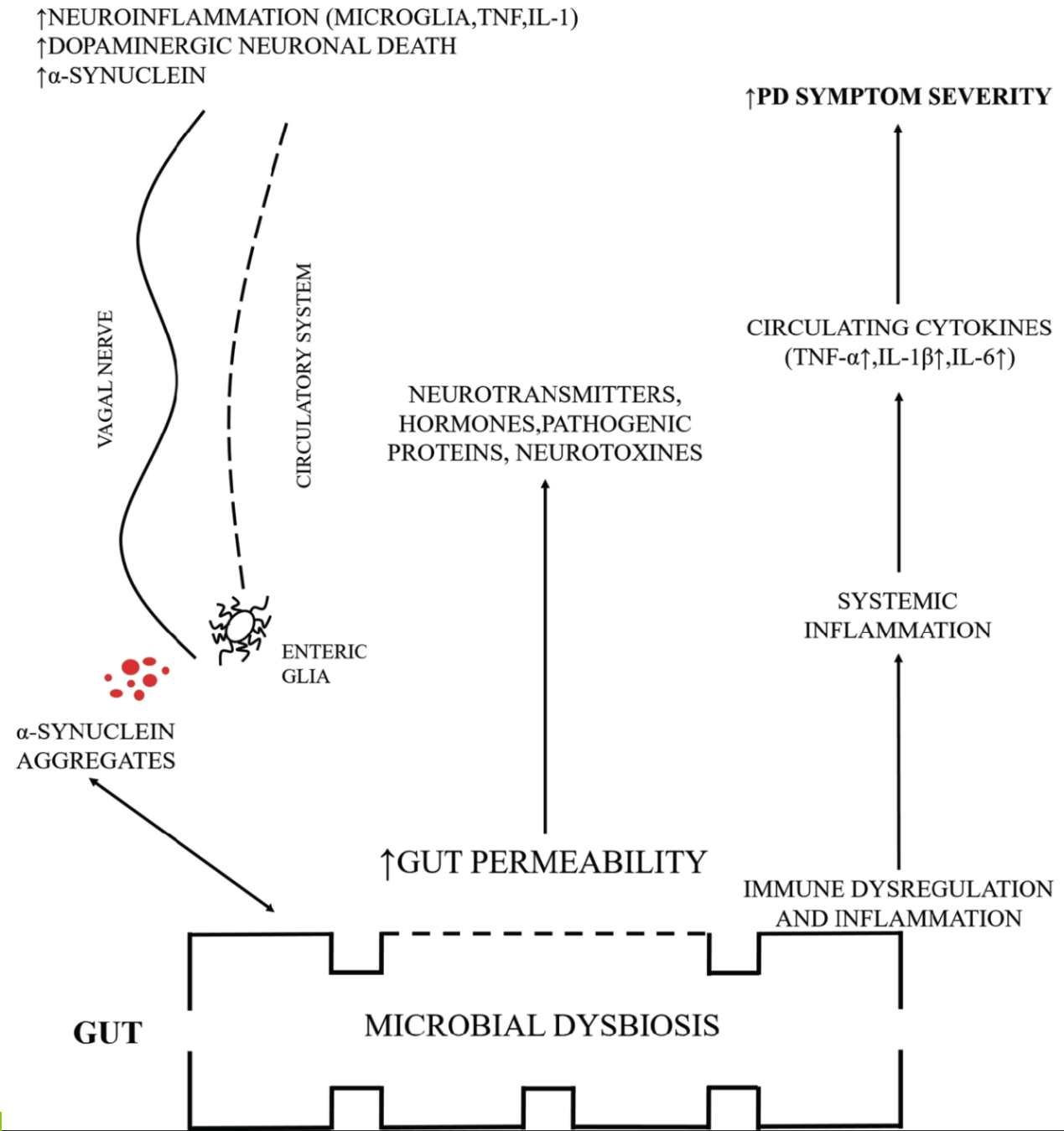


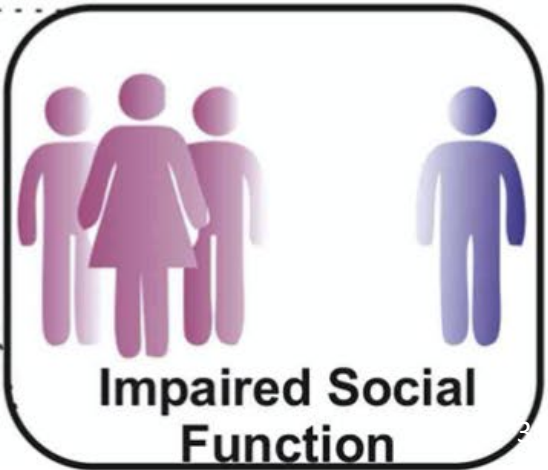
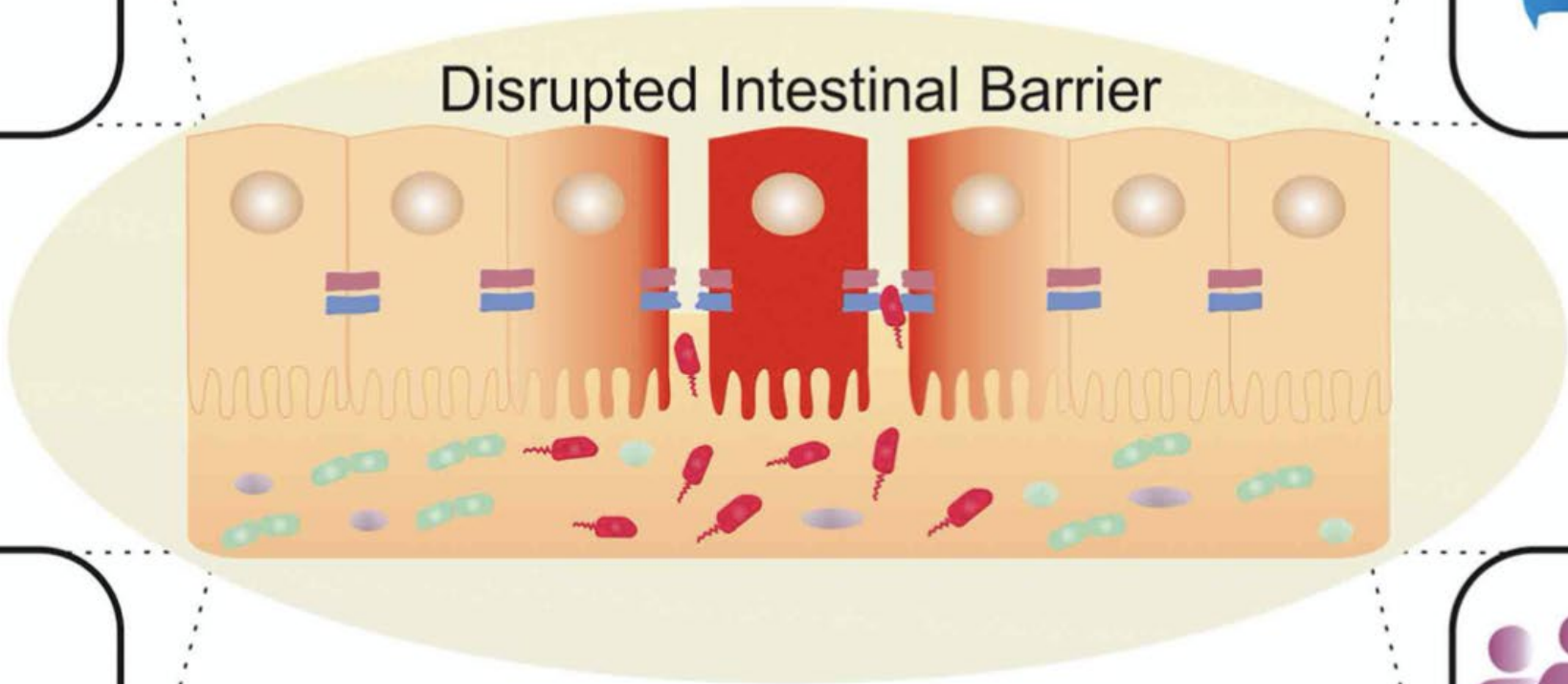
# Mikrobiom und Neuroinflammation



# Mikrobiom, Leaky gut und Morbus Parkinson

## BRAIN AFFECTED WITH PD



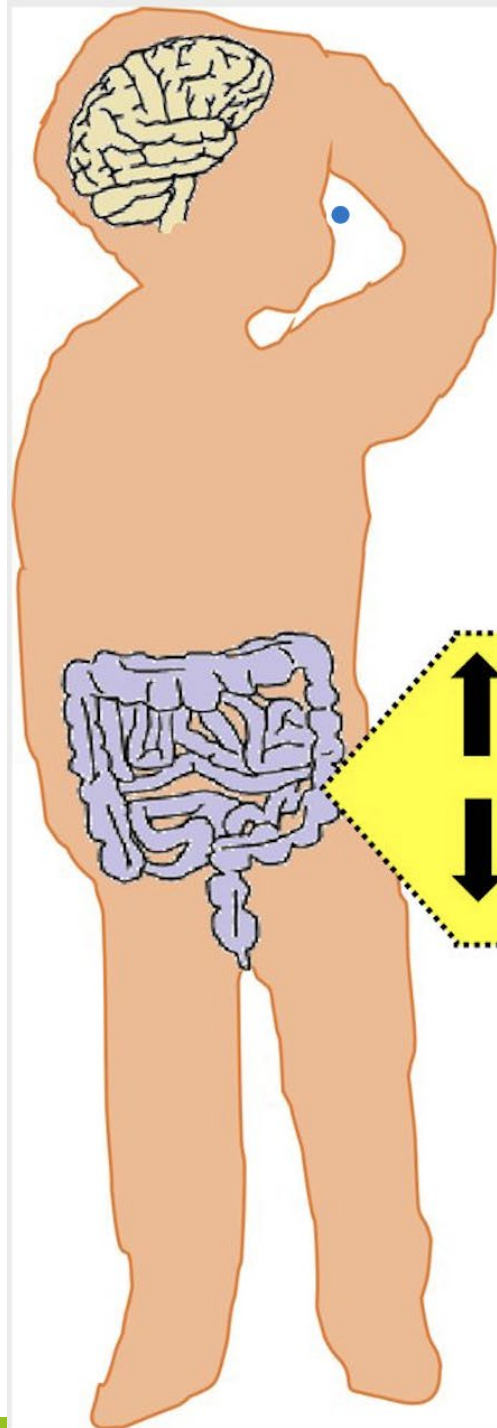


Kelly 2015

# Darmbakterien beeinflussen unser Verhalten

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

Und das geht  
sehr weit



# Autism

- Impaired social interaction and communication
- restricted patterns of interest and repetitive behaviours

↑  
*Proteobacteria*  
*Bacteroides*  
↓  
*Firmicutes*  
*Actinobacteria*

## DYSBIOSIS

*Altered gut microbiome*

**Inflammation** ↑  
↑ Pro-inflammatory cytokines (IL-6, IL-10, TNF $\alpha$ )

**Toxic metabolite production** ↑

↑ Phenols, p-cresol, indole derivatives

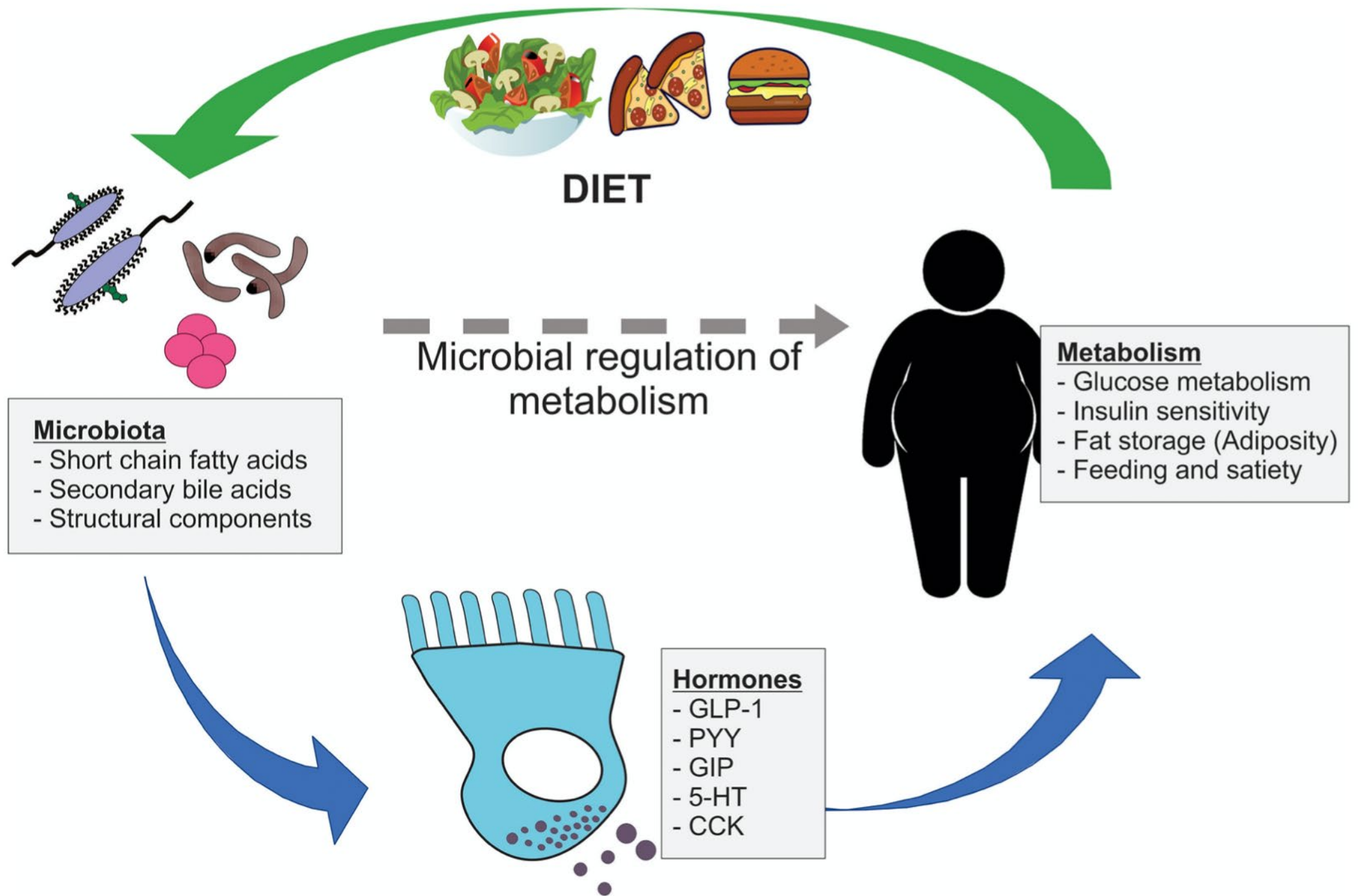


Ernährung

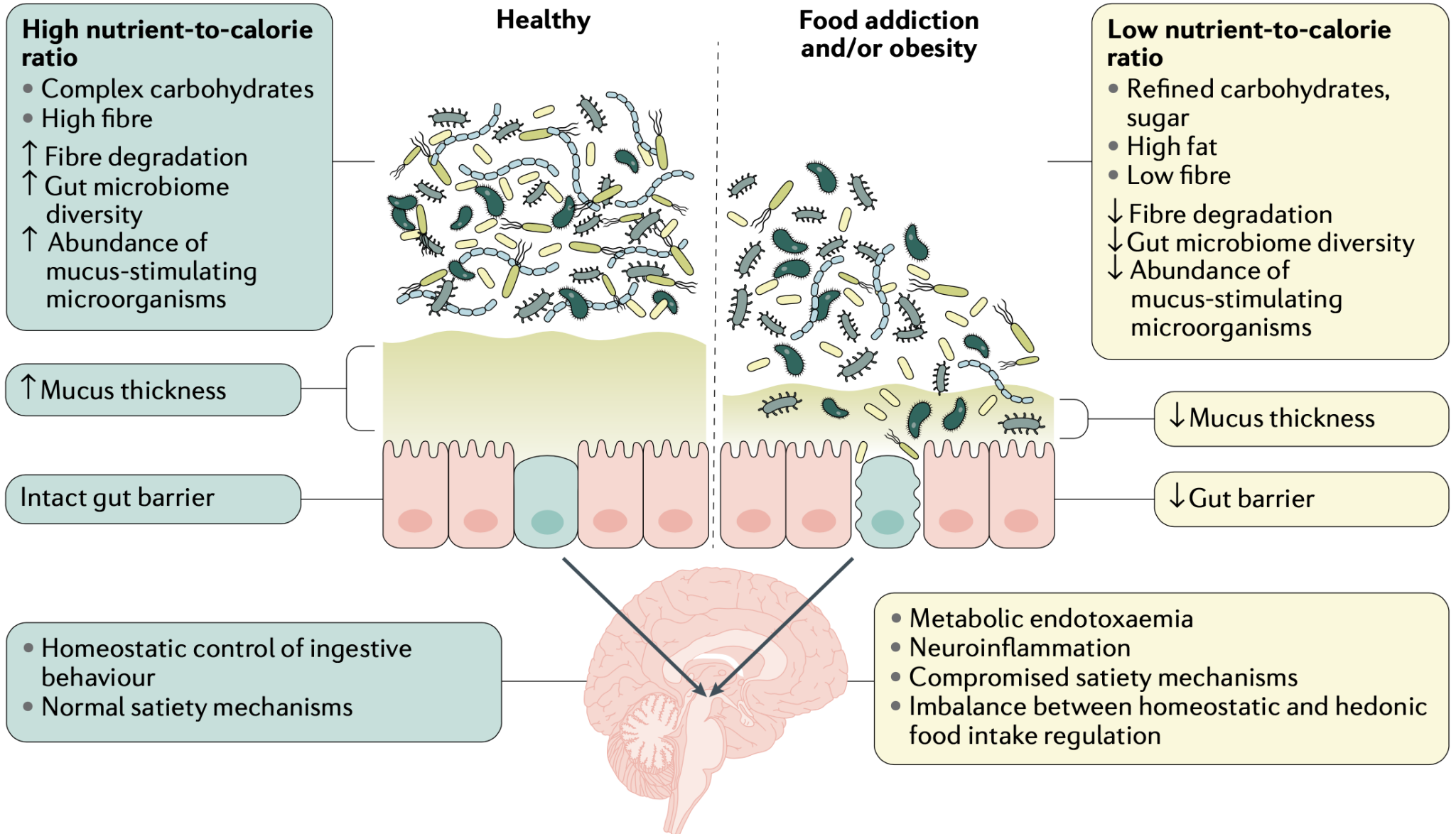
Bewegung

Stress

Konsequenzen



# Kalorien vs. Nährstoffdichte

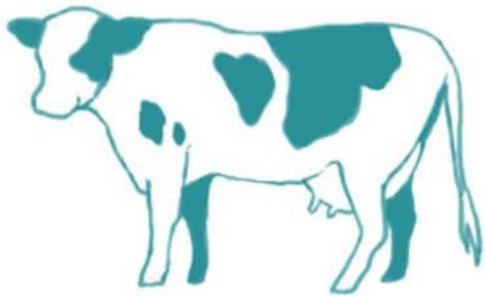


# Pflanzliche vs. tierische Proteine

## Plant Protein



## Animal Protein



→ ↑*Bifidofacterium*  
↑*Lactobacillus*  
↓*Bacteroides*  
↓*Clostridium perfringens*

→ ↑*Bacteroides*  
↑*Alistipes*  
↑*Bilophila*  
↑*Ruminococcus*  
↓*Bifidobacterium*

→ ↑SCFA's

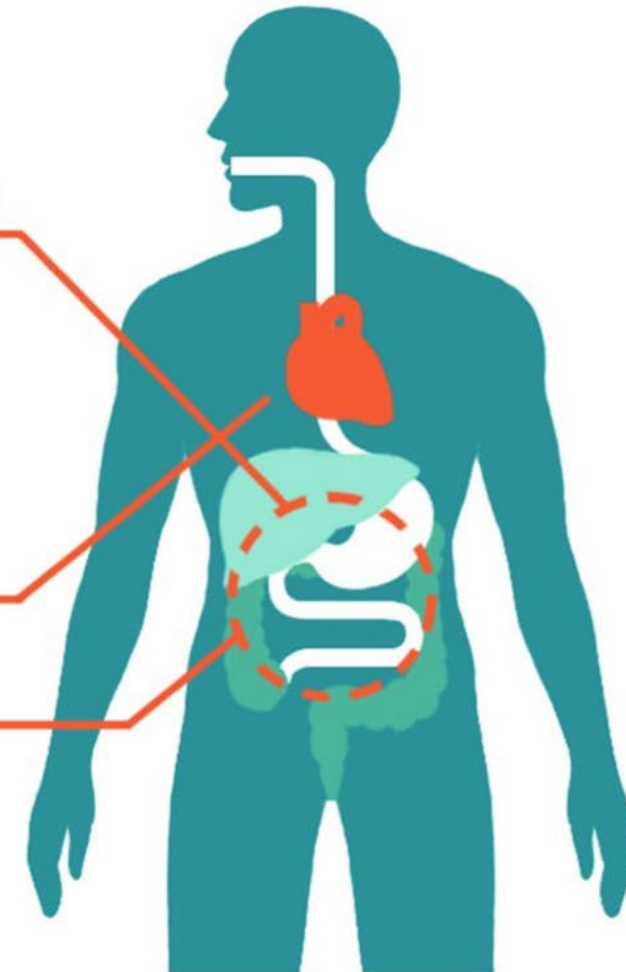
→ ↑TMAO

→ ↓SCFA's

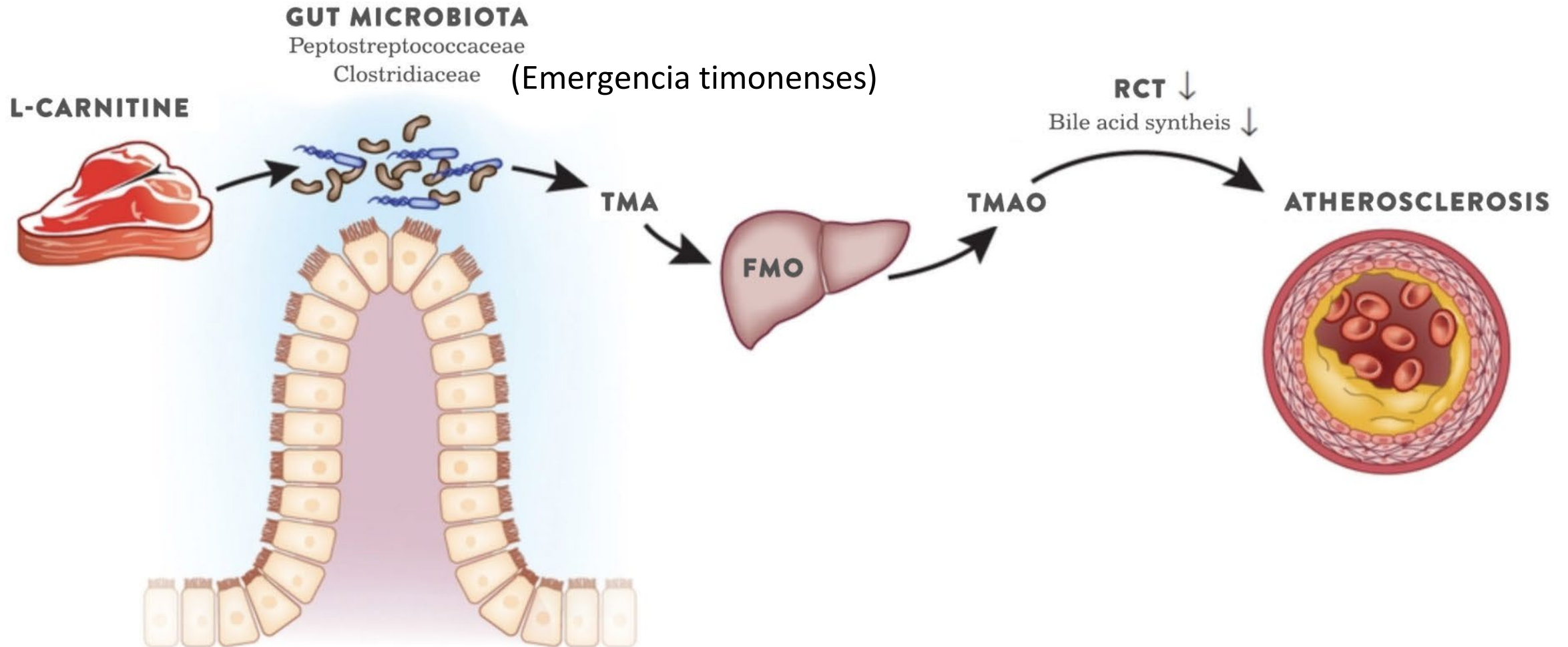
↑Gut Barrier  
↑Tregs  
↓Inflammation

CVD

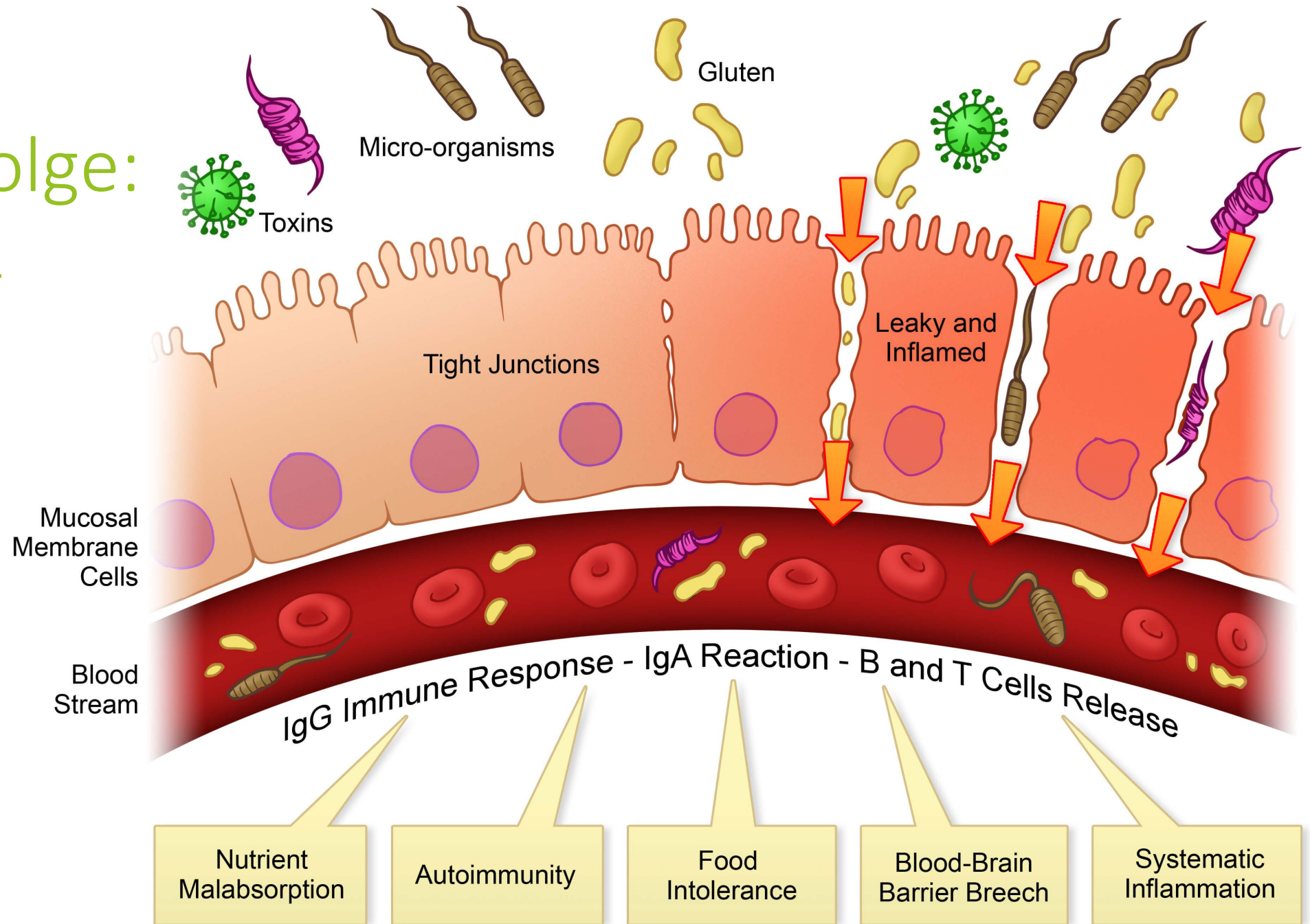
IBD



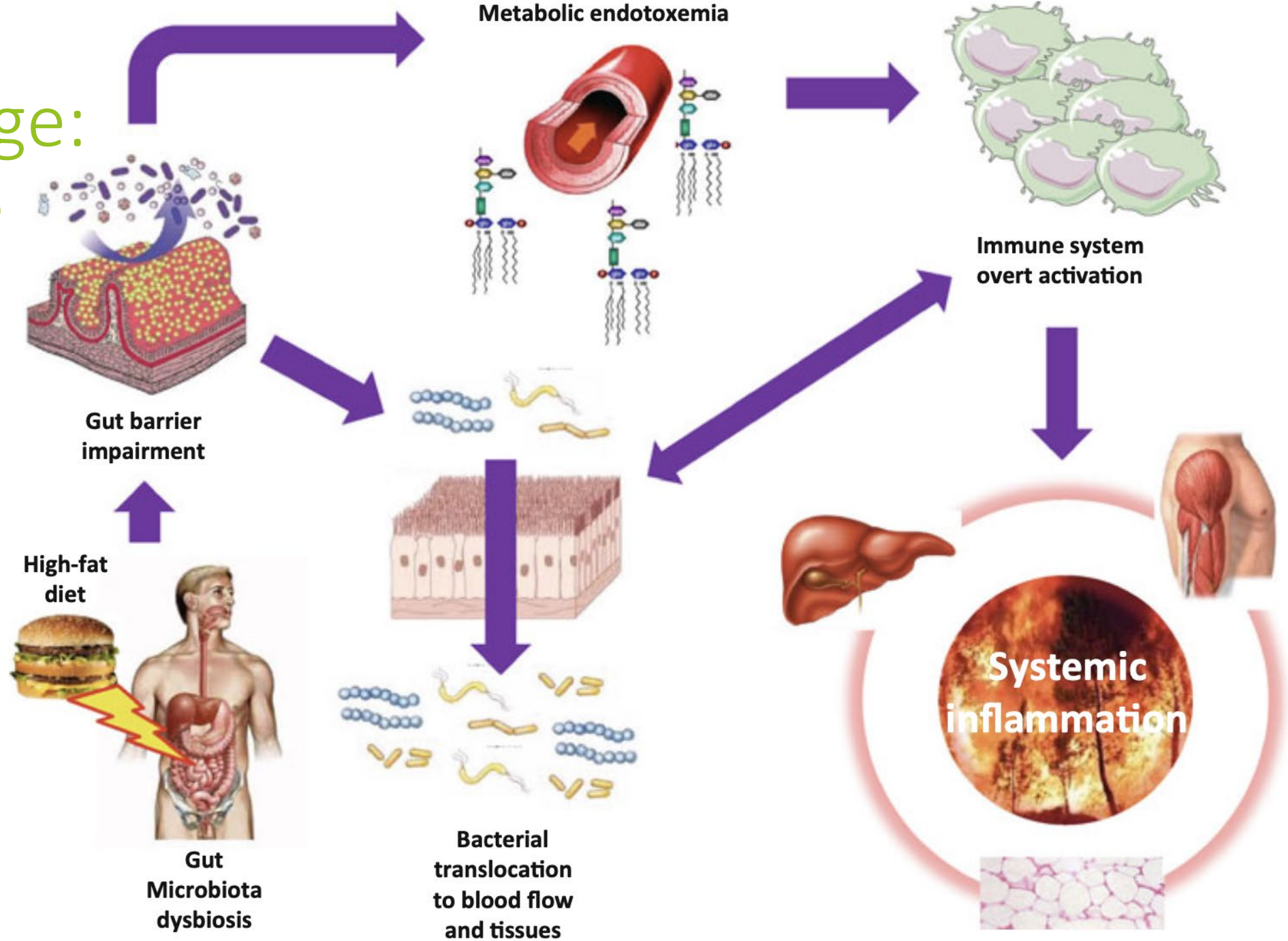
# Trimethylamin: Problem tierische Einweise



# Mögliche Folge: Leaky Gut 1



# Weitere Folge: systemische Entzündung



Ernährung

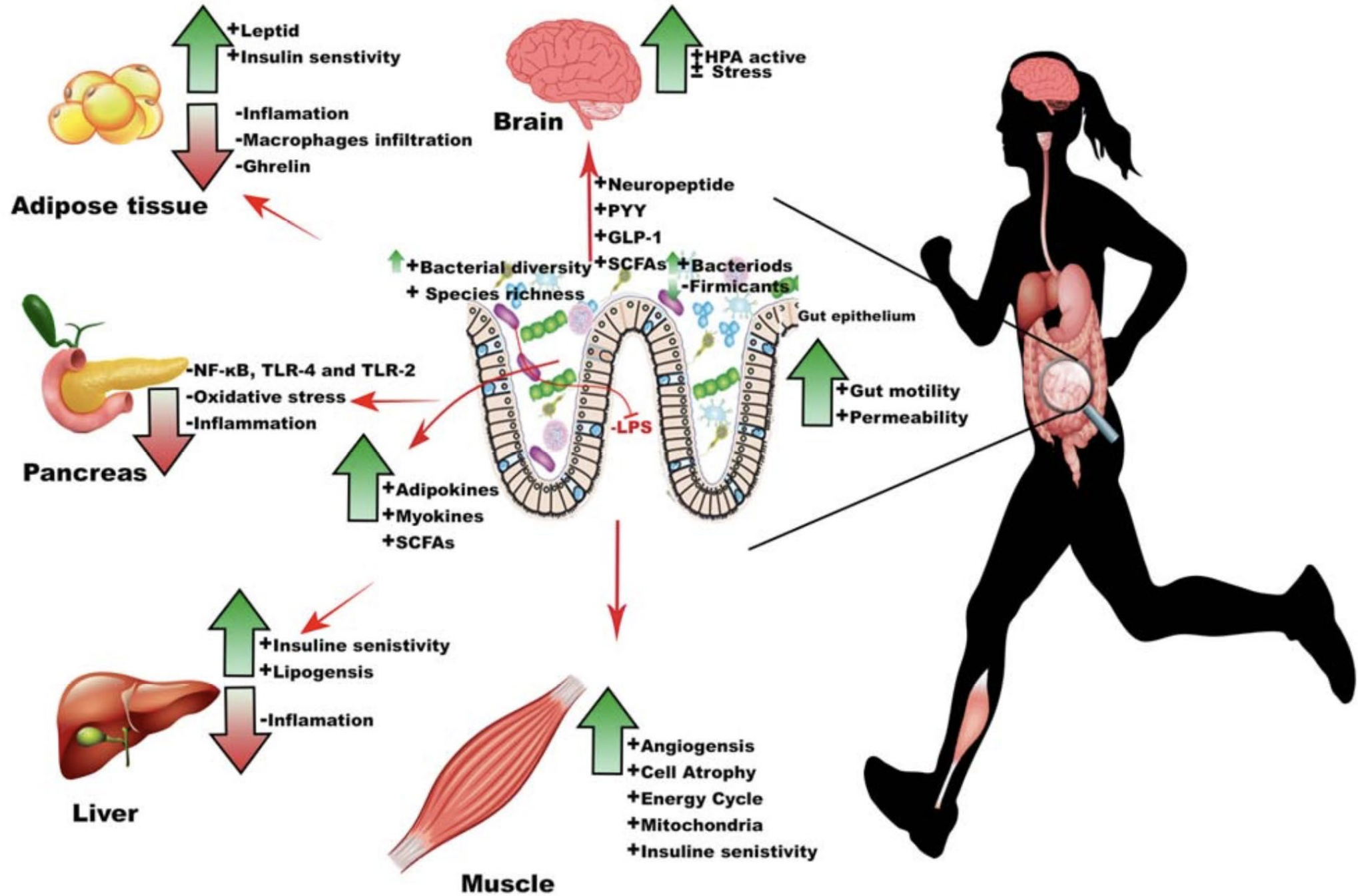
Bewegung

Stress

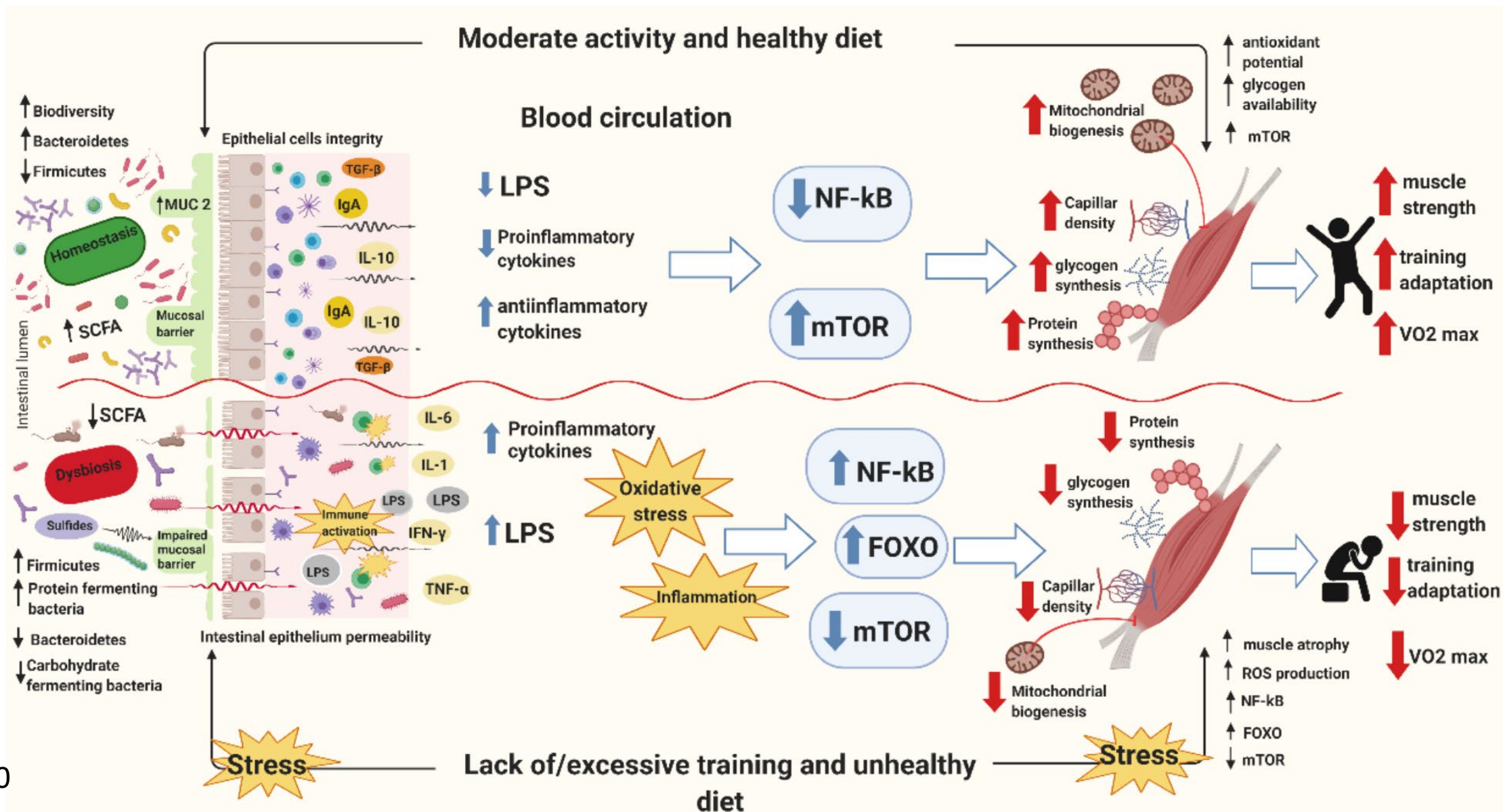
Konsequenzen



# Bewegung



# Bewegung oder Bewegungsmangel



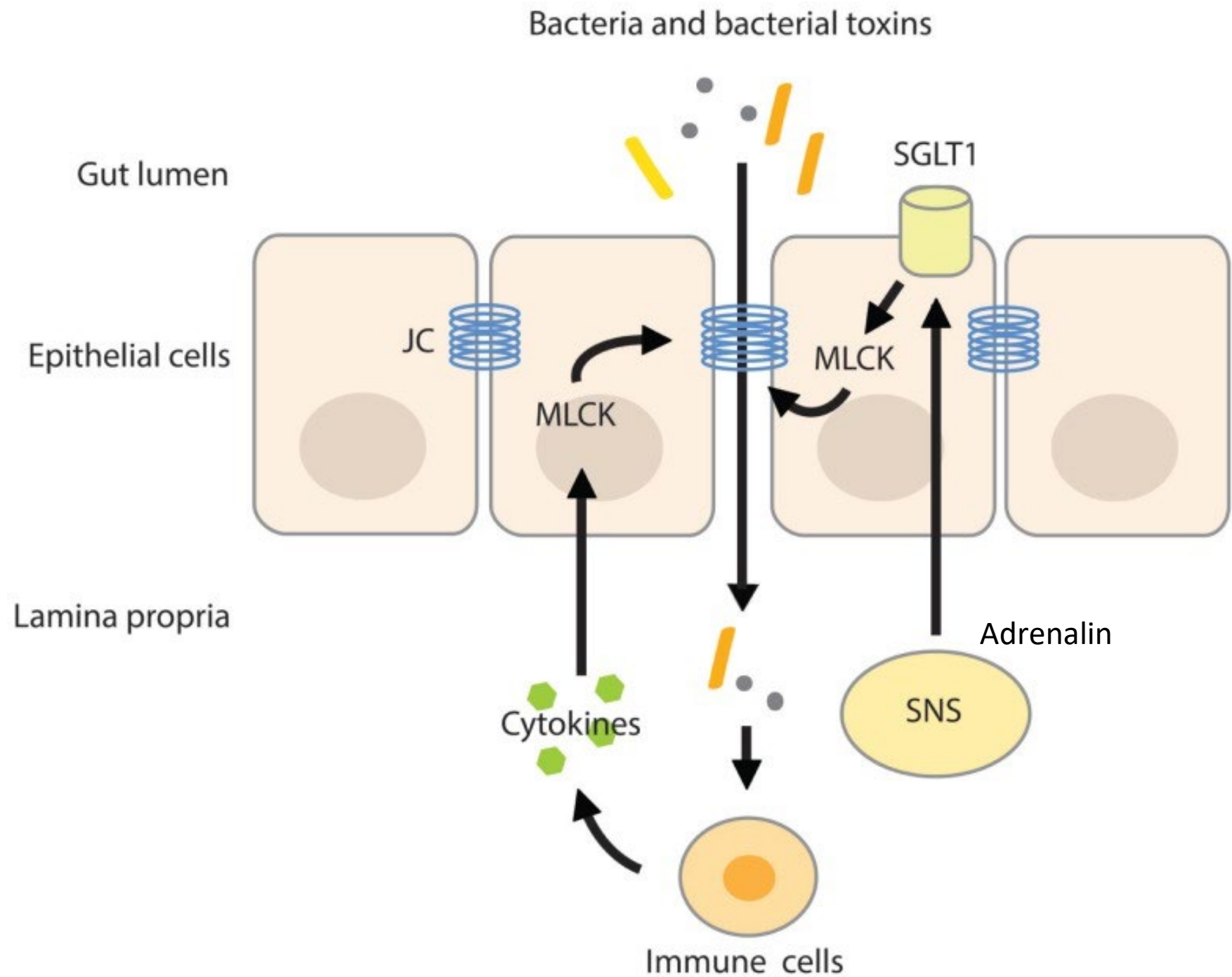
Ernährung

Bewegung

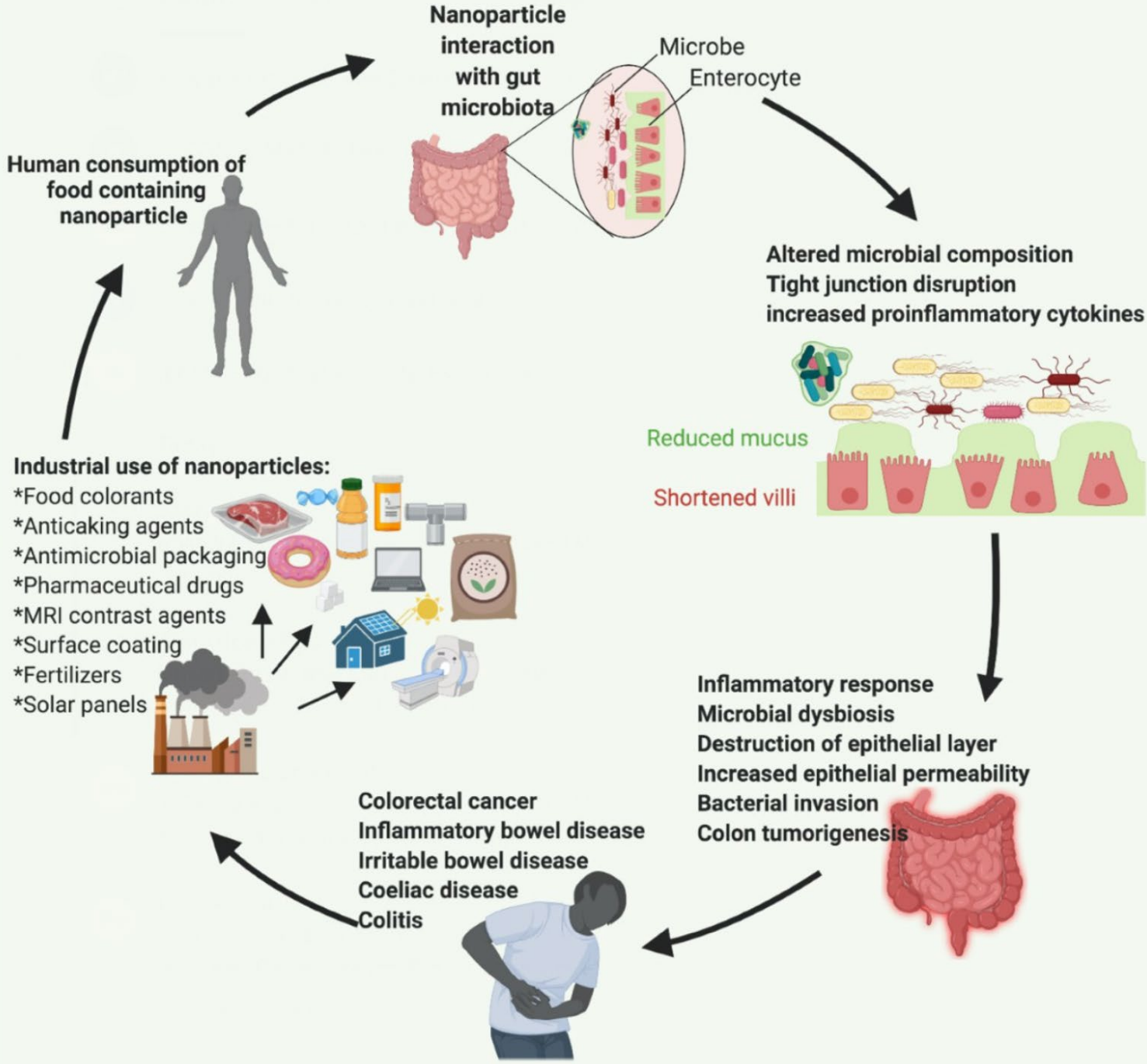
Stress

Konsequenzen

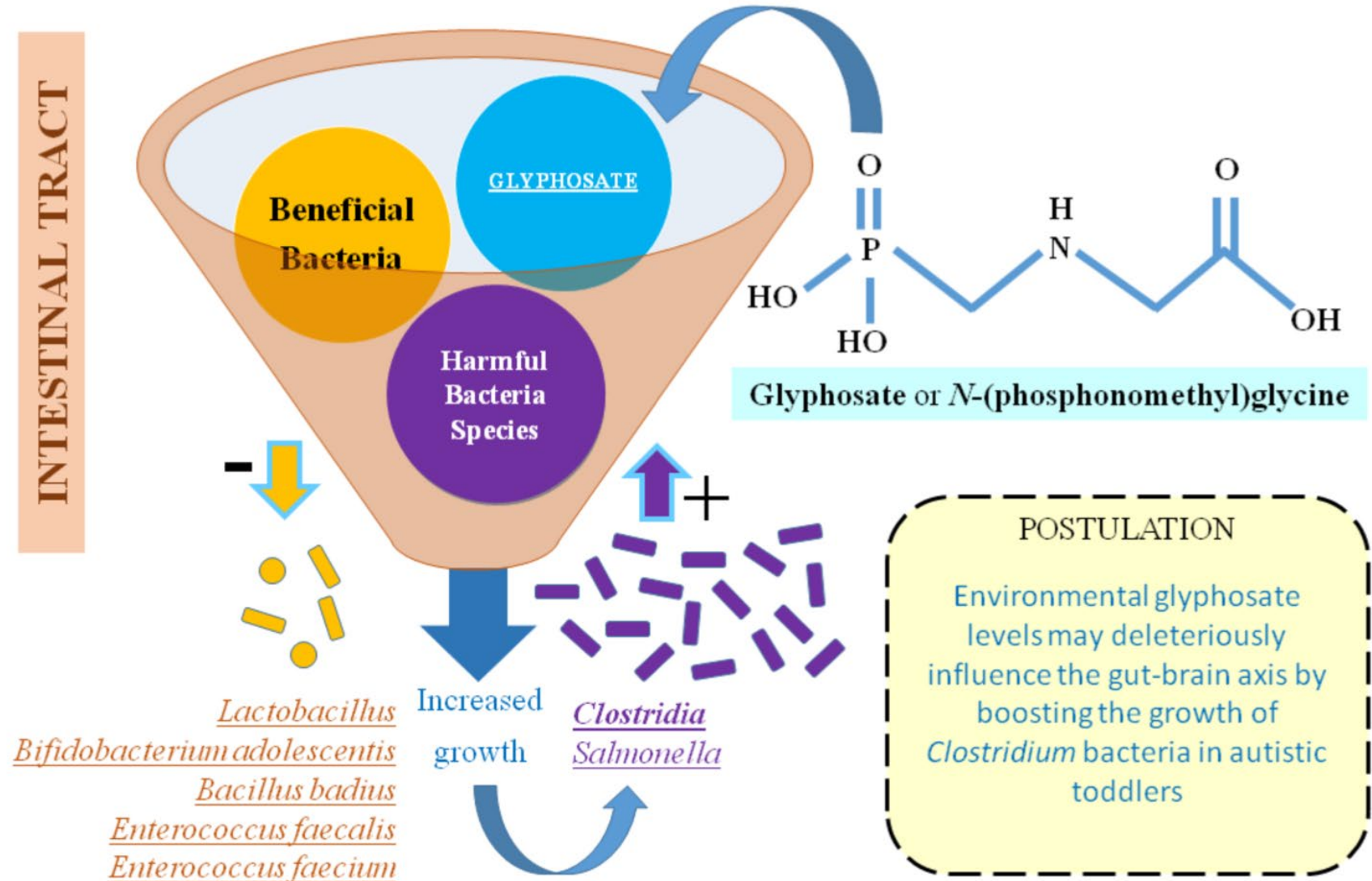
# Leaky Gut 2: Stress

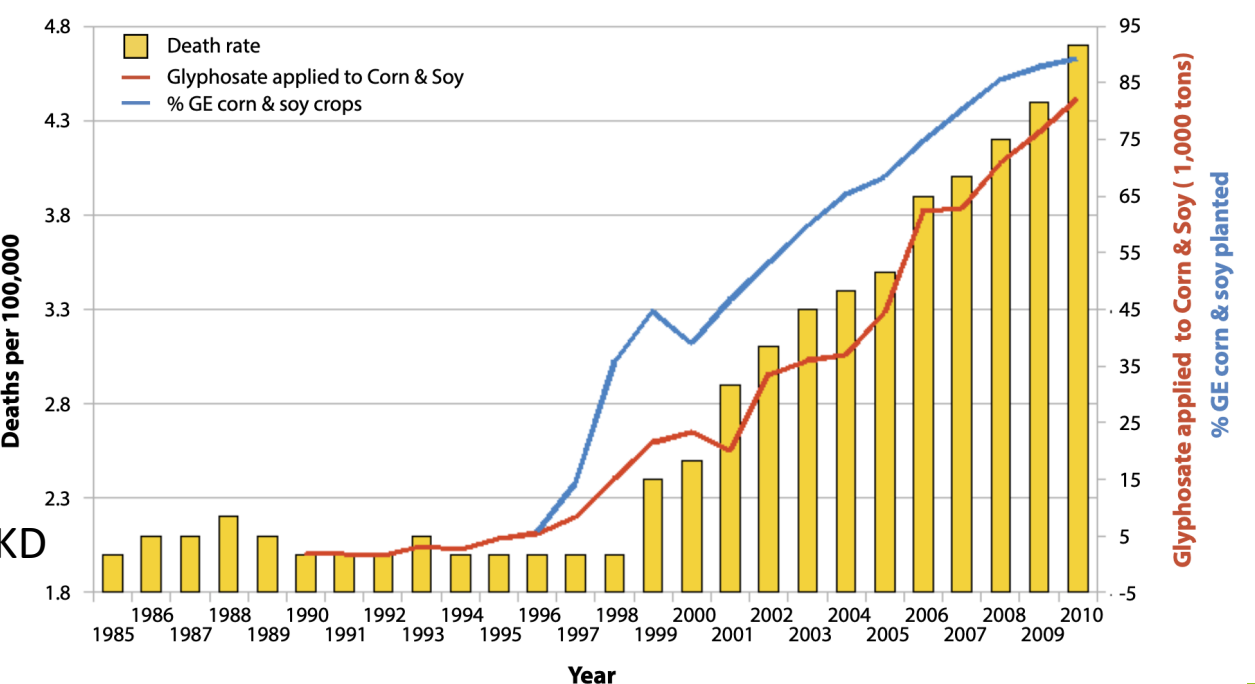
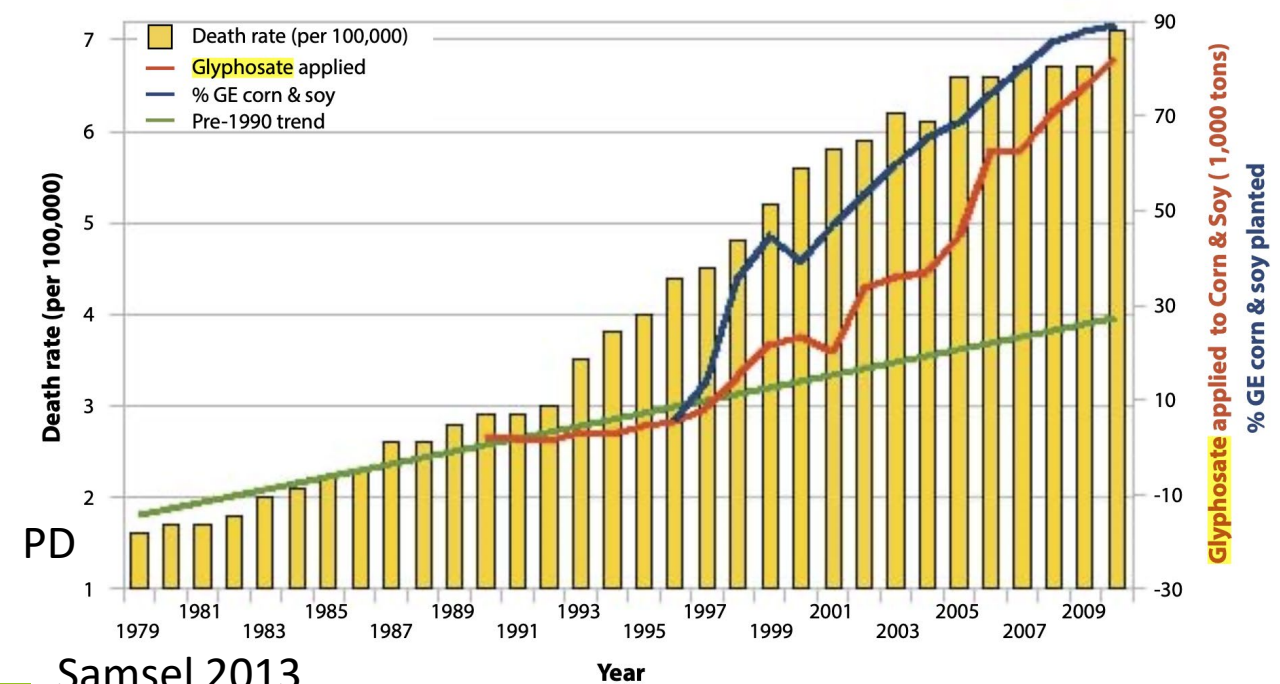
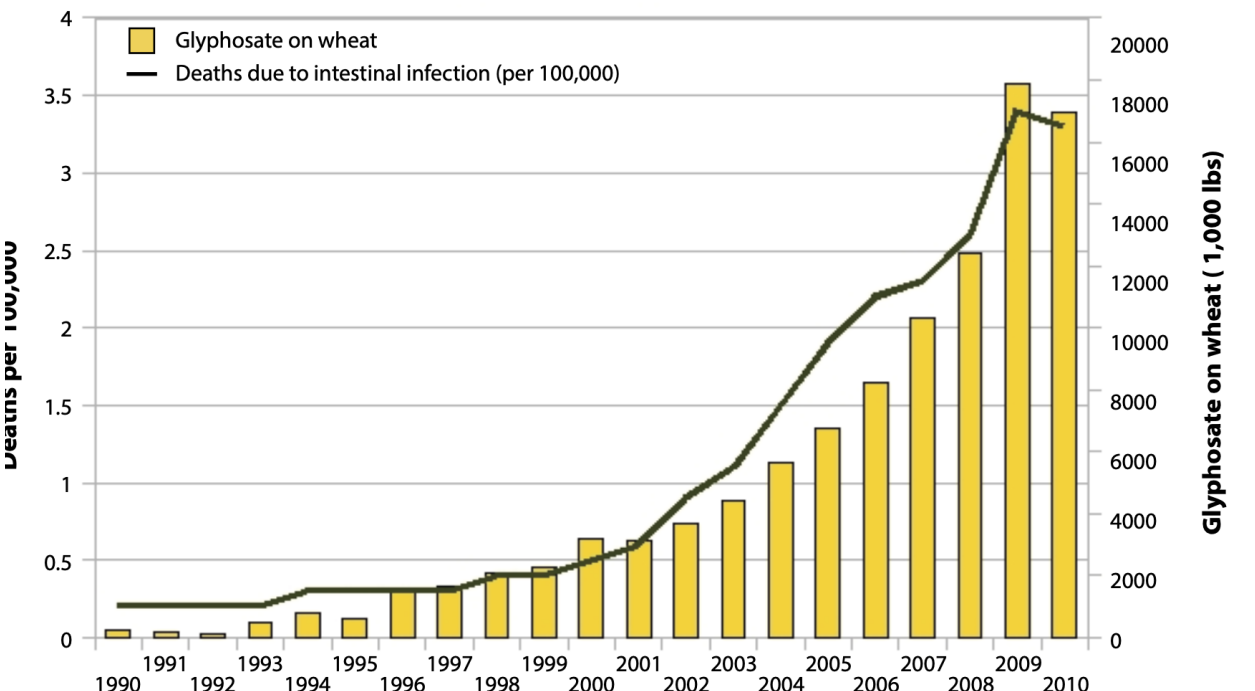
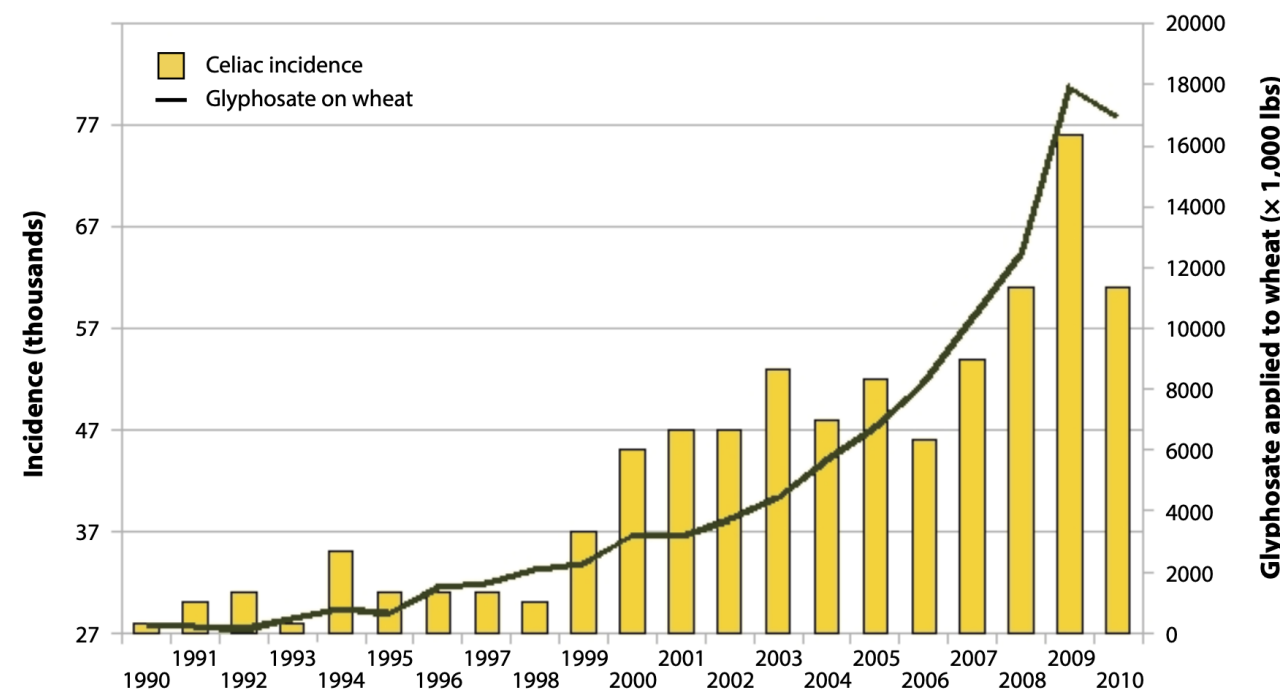


# Nanopartikel und Mikrobiom



# Glyphosat und Mikrobiom





Ernährung

Bewegung

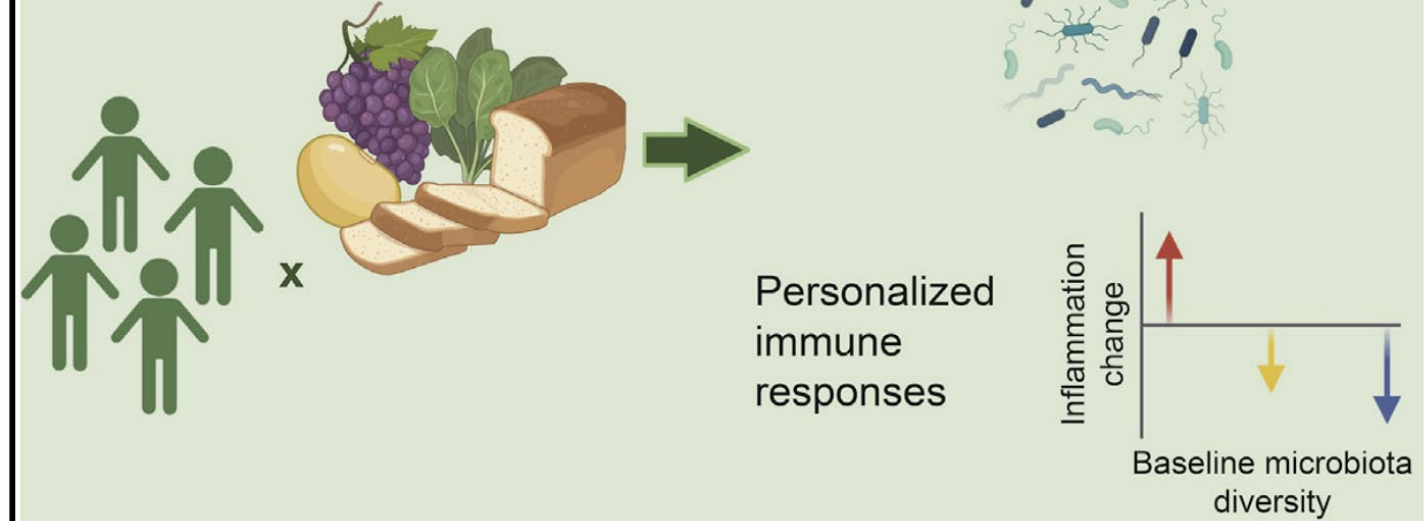
Stress

Konsequenzen

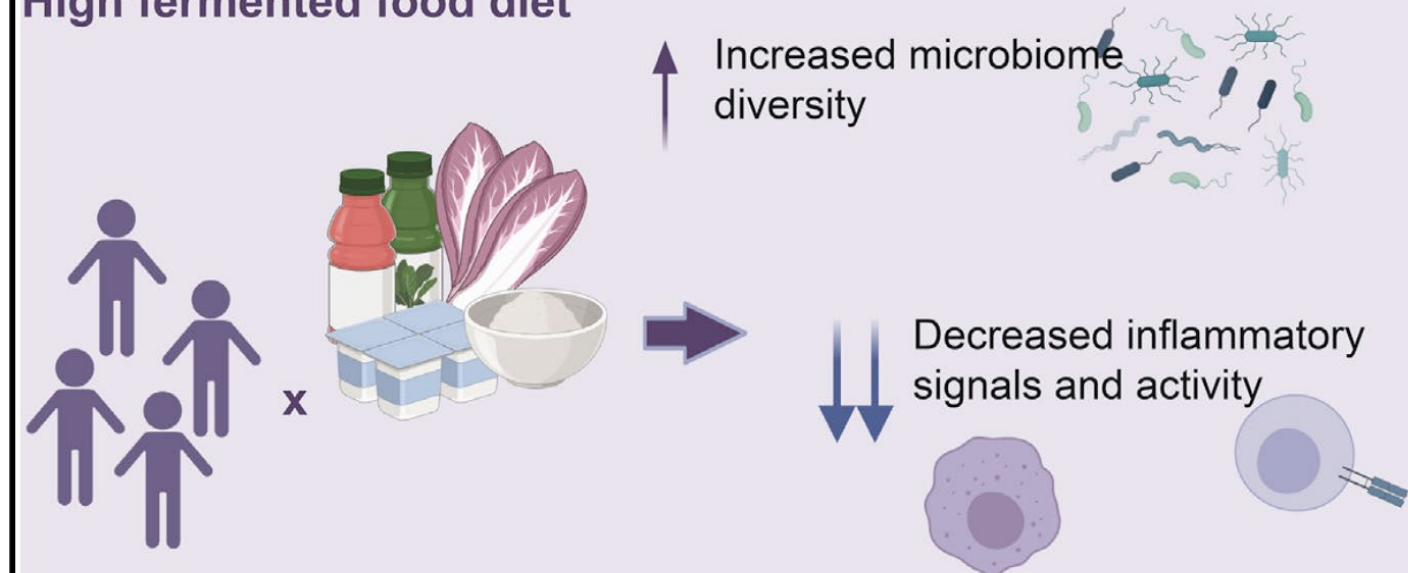


# Faserstoffe und fermentierte Lebensmittel

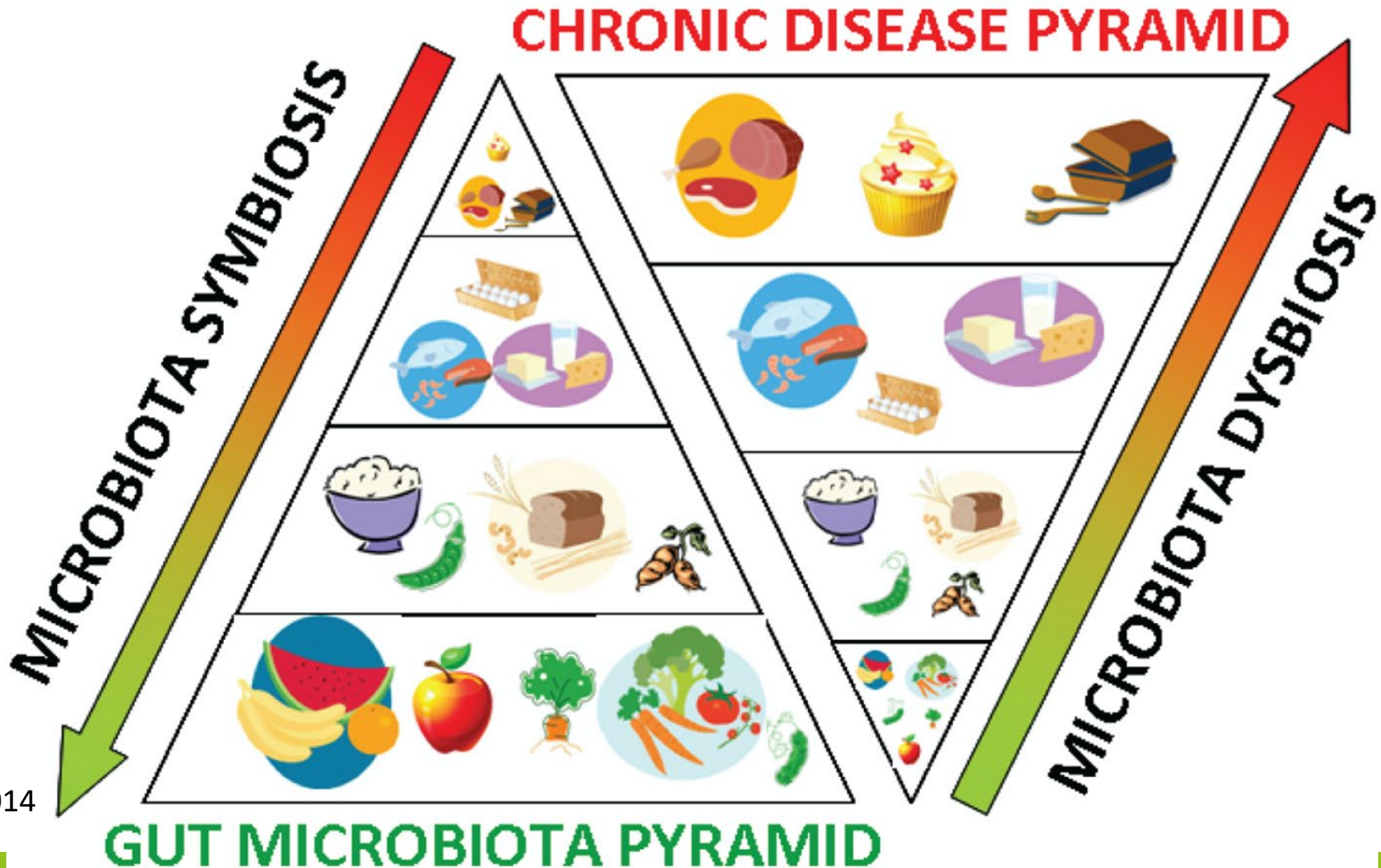
## High fiber diet



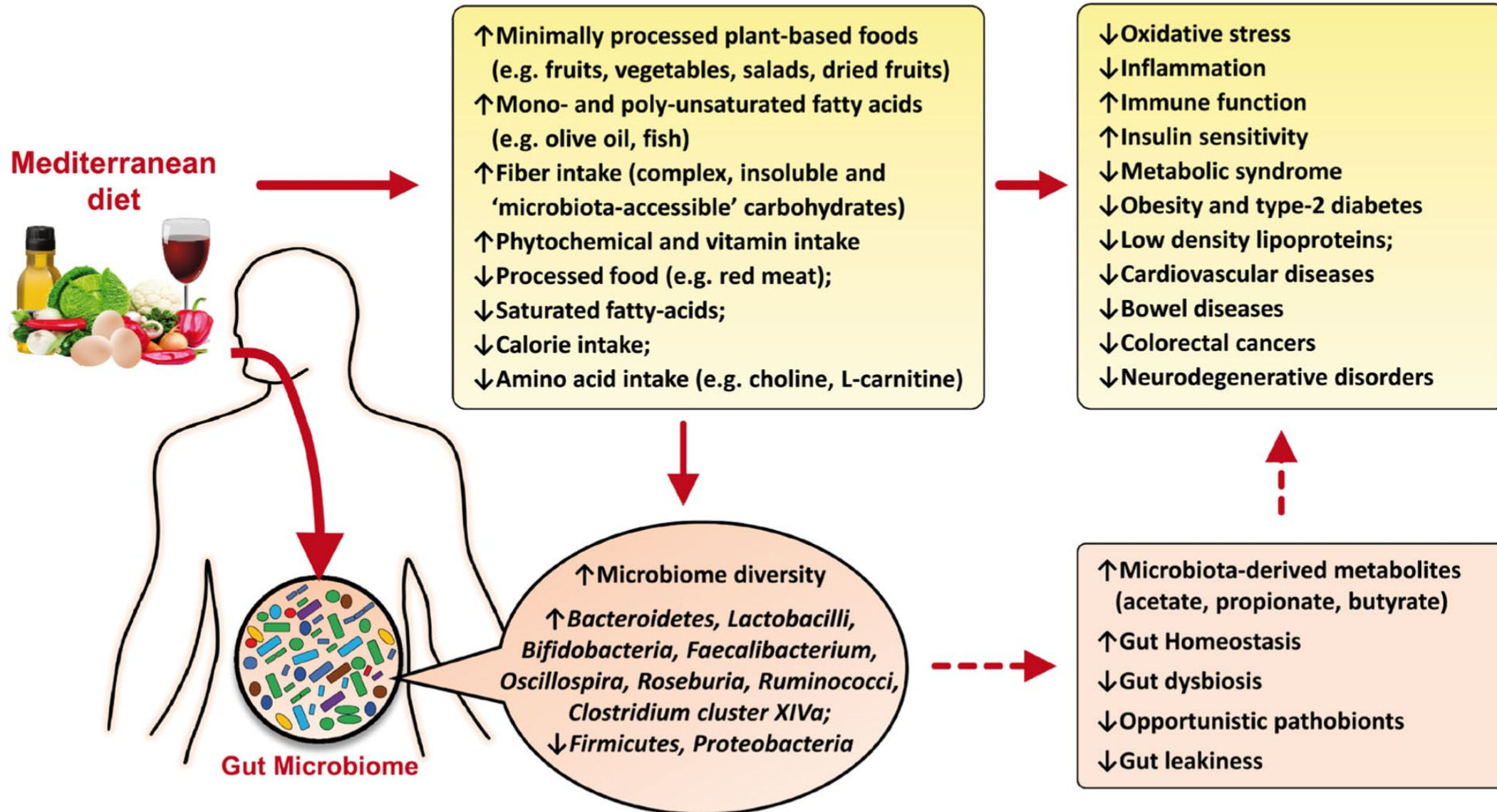
## High fermented food diet



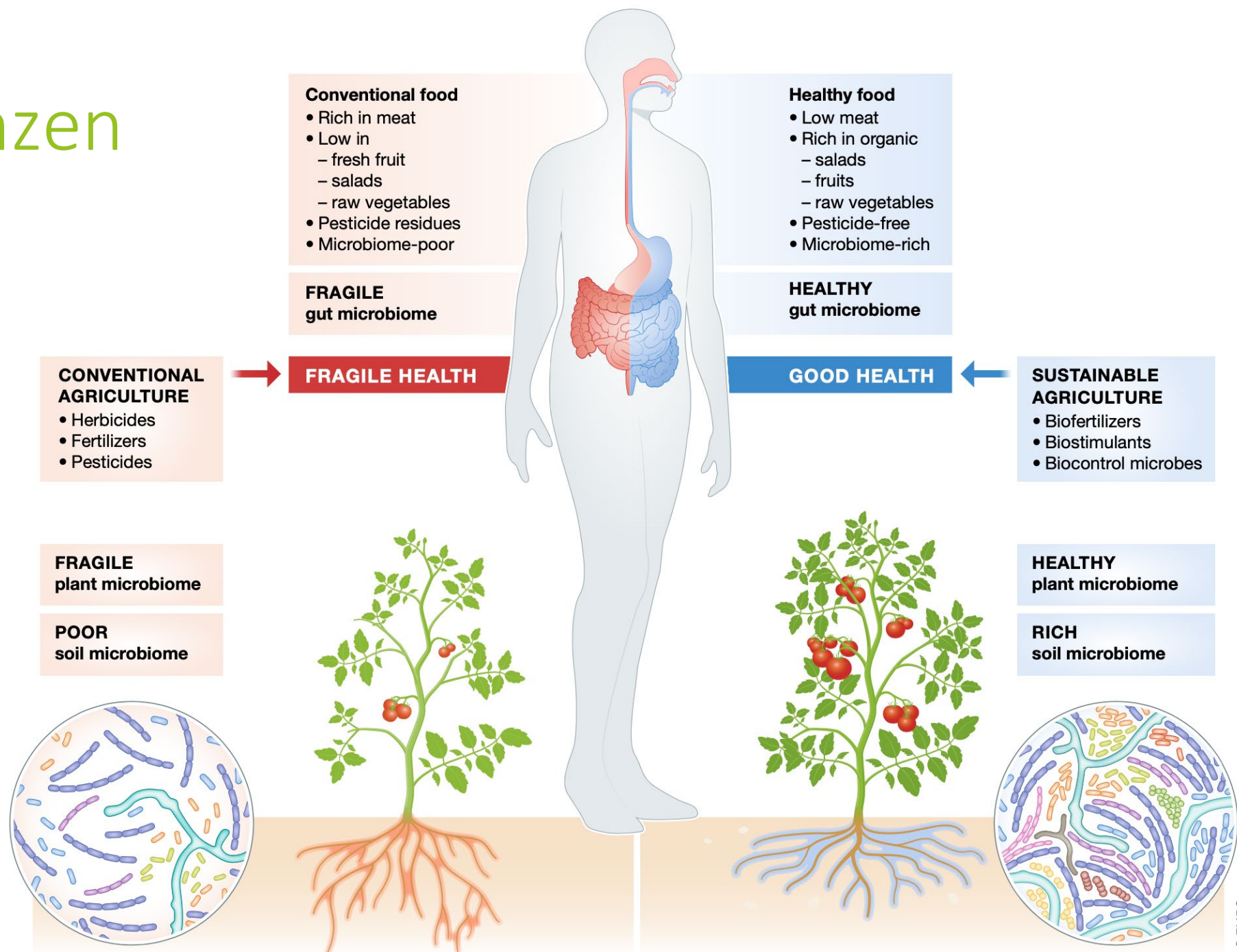
# Mediterranean v Western diet



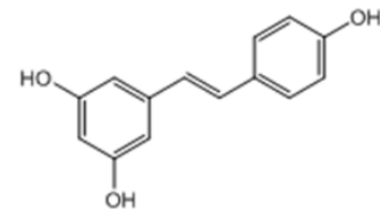
# Warum mediterrane Ernährung?



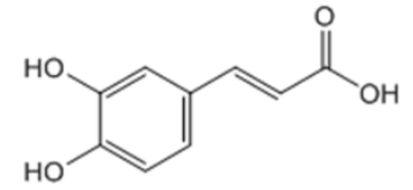
# Gesunde Pflanzen sind gesund



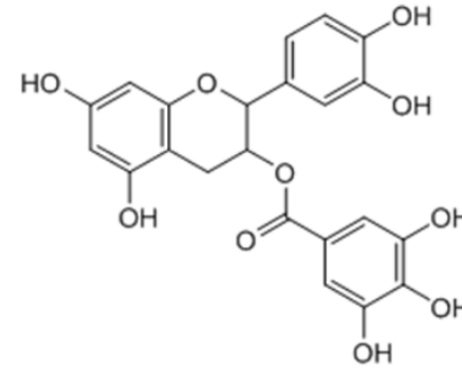
# Sekundäre Pflanzenstoffe



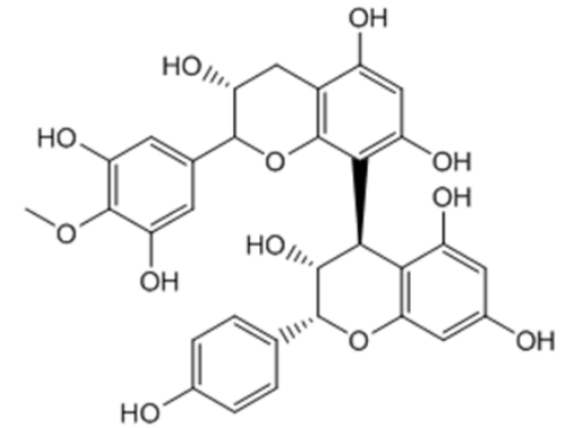
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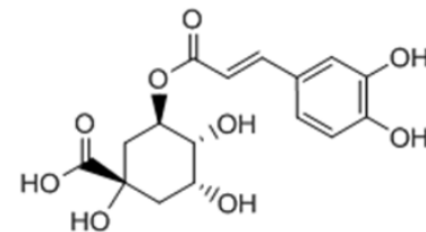
D



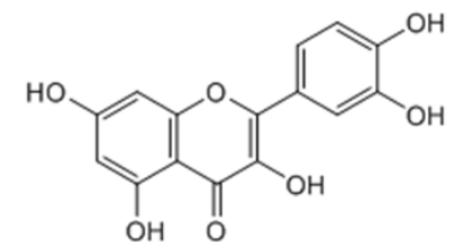
E



F



G

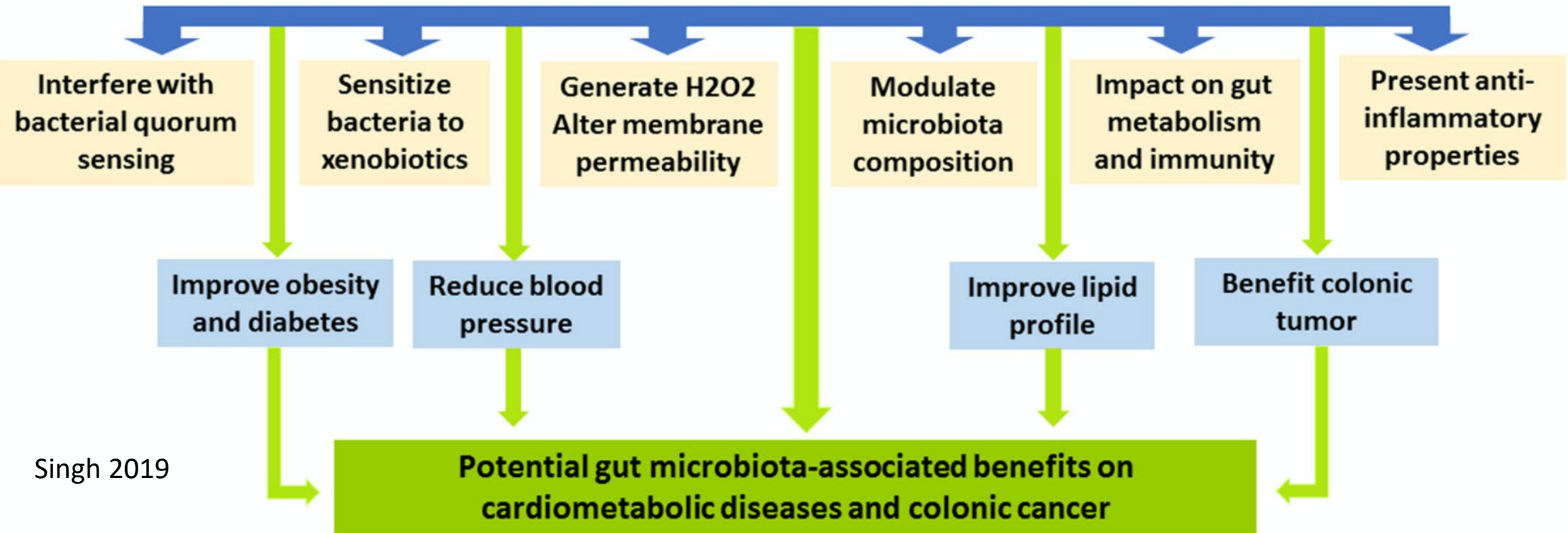


H

Some of the major dietary sources of polyphenols:




### Dietary POLYPHENOLS



Singh 2019

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.

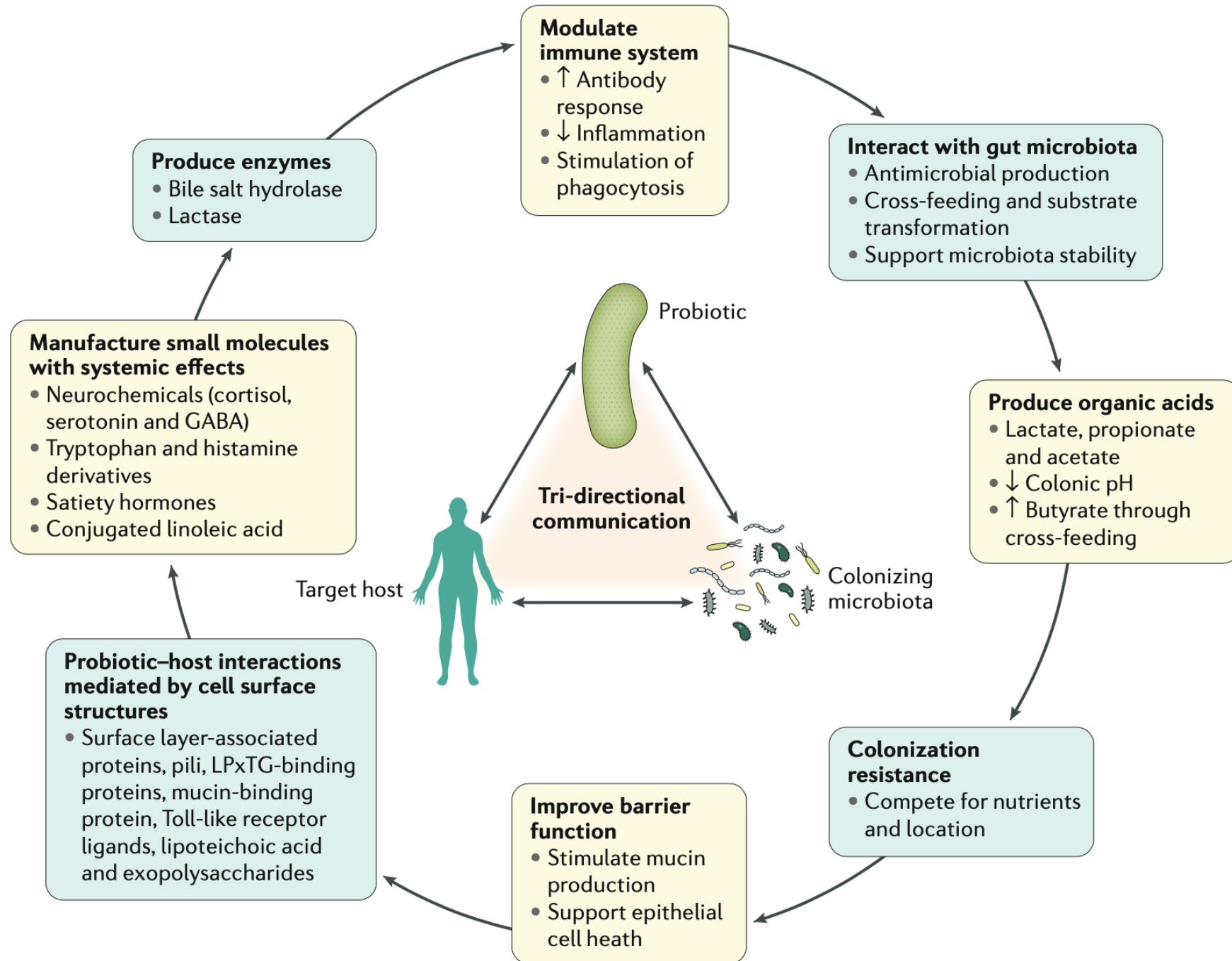
Results

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

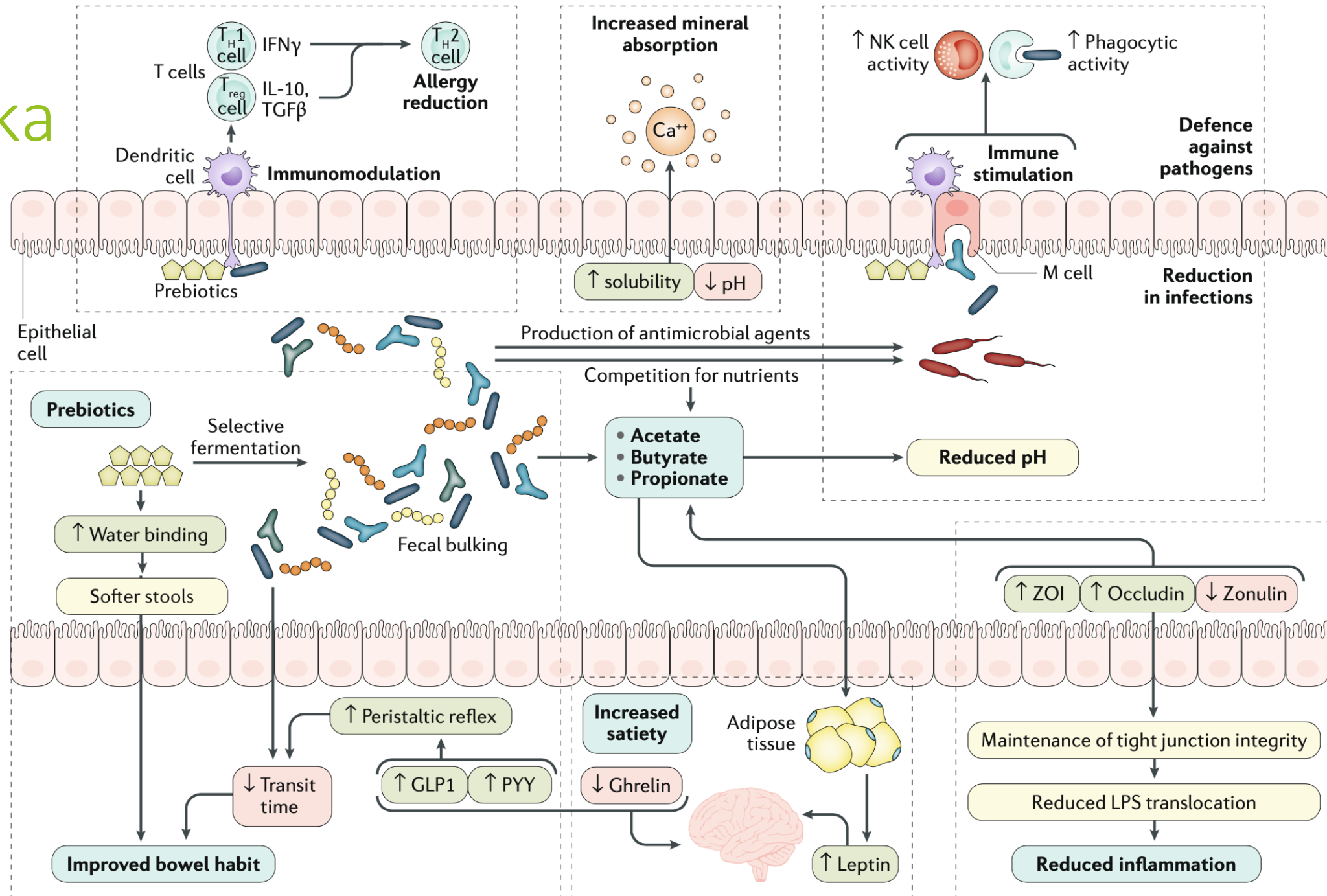
The use of olive oil and onion in Mediterranean cooking as a base for sauces and dishes, with an appropriate cooking time, preserve the polyphenol content of food. Thus, Mediterranean cuisine may contribute to the health effects of the Mediterranean diet. © 2019 Society of Chemical Industry

# Probiotika

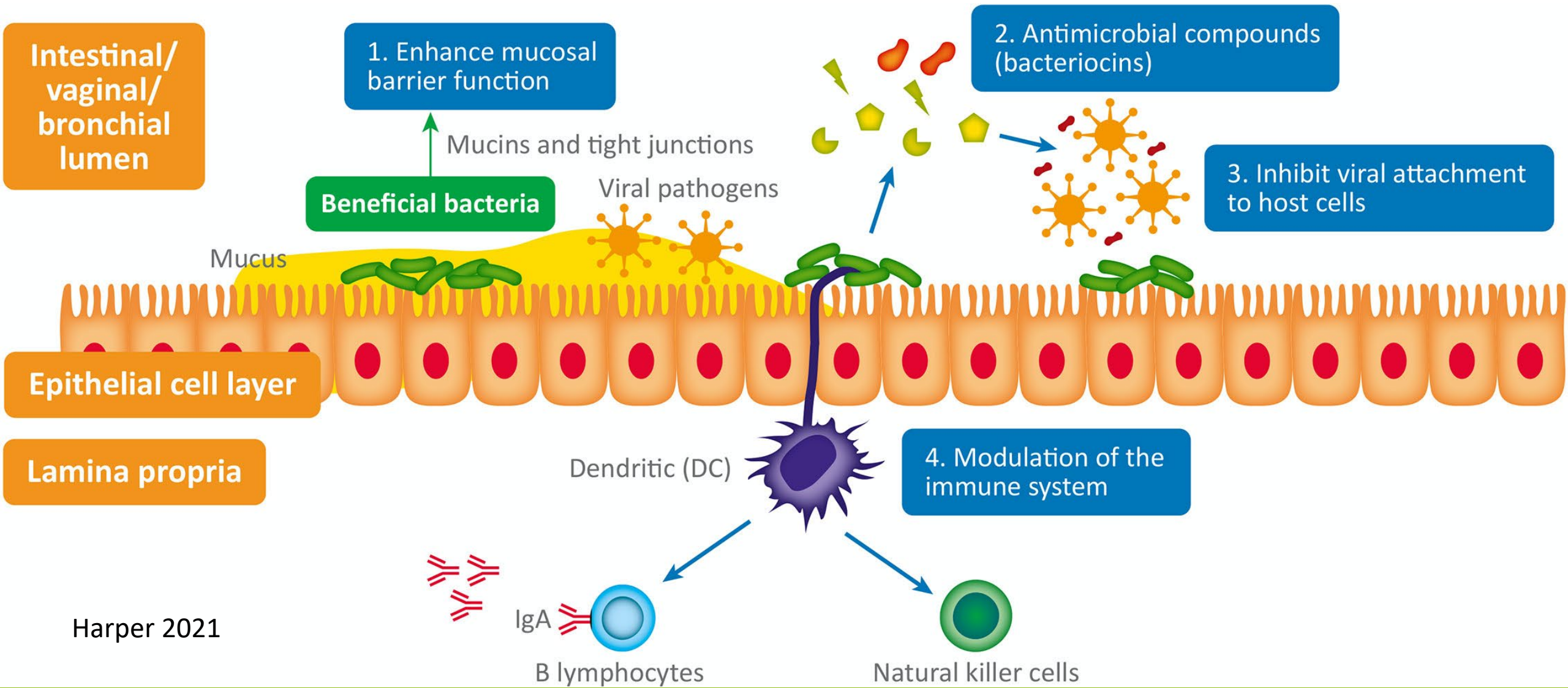




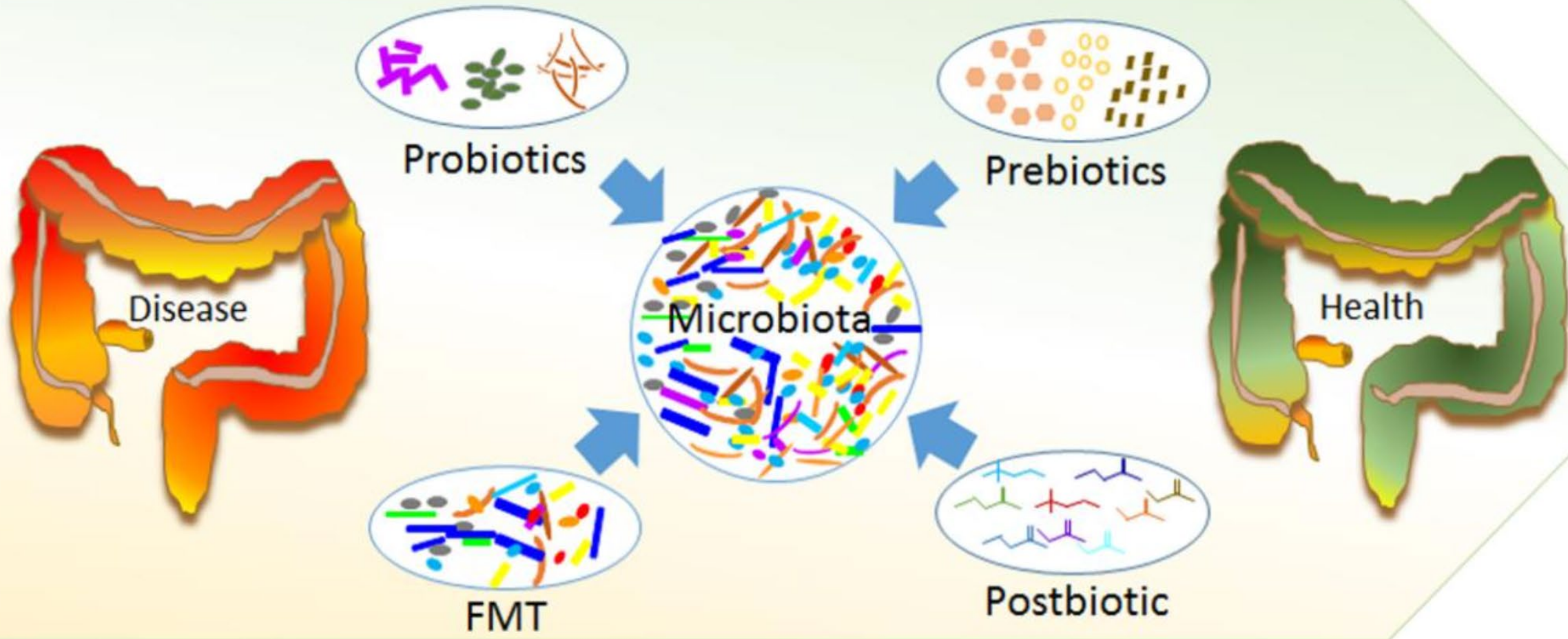
# Prebiotika



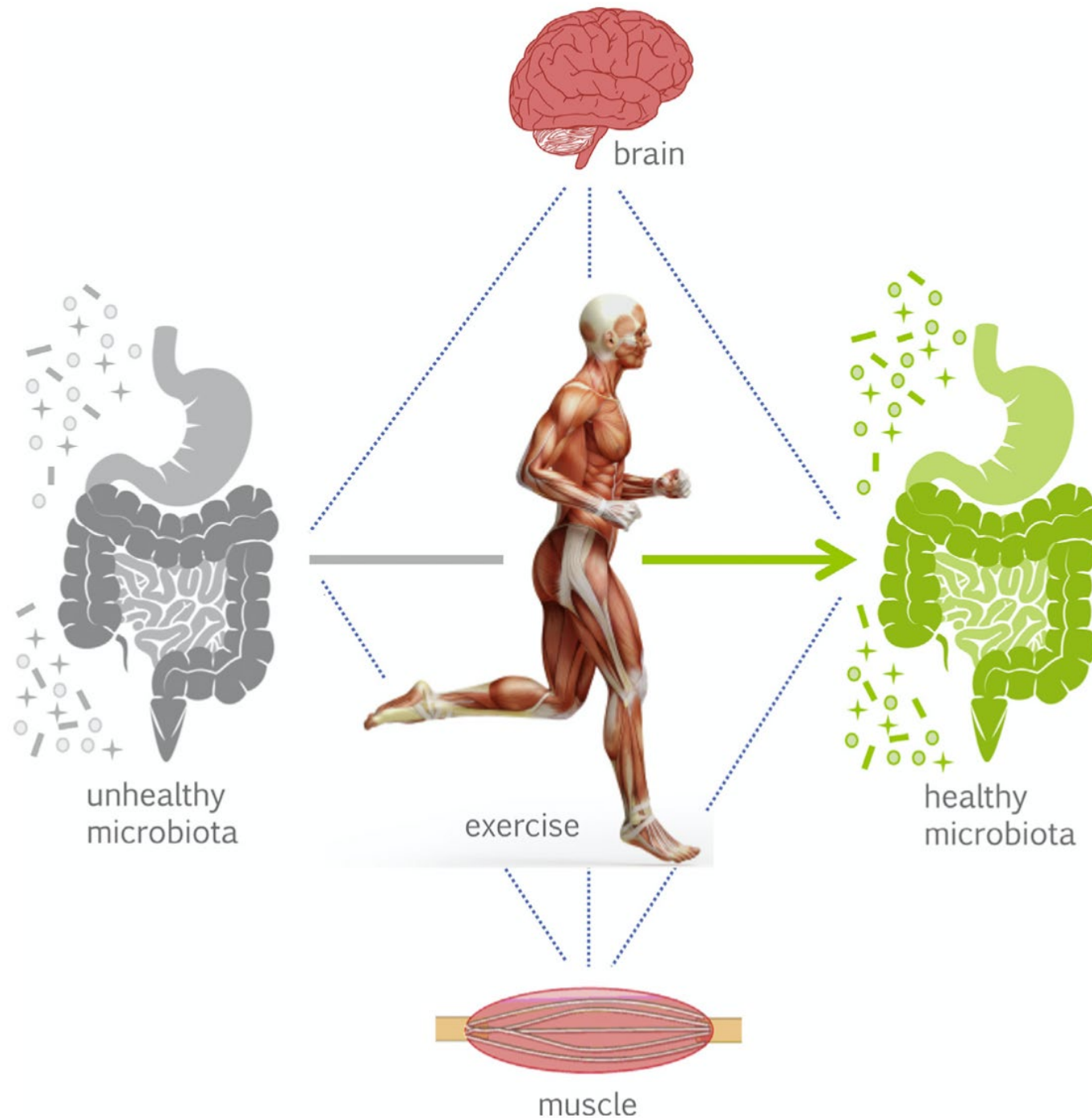
# Probiotika: auch antiviral



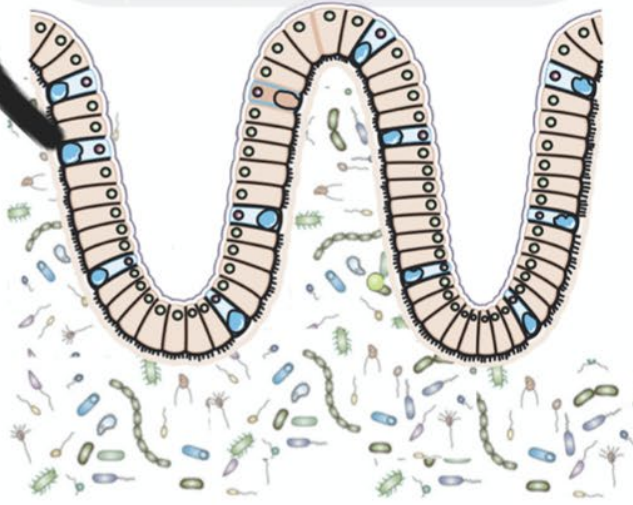
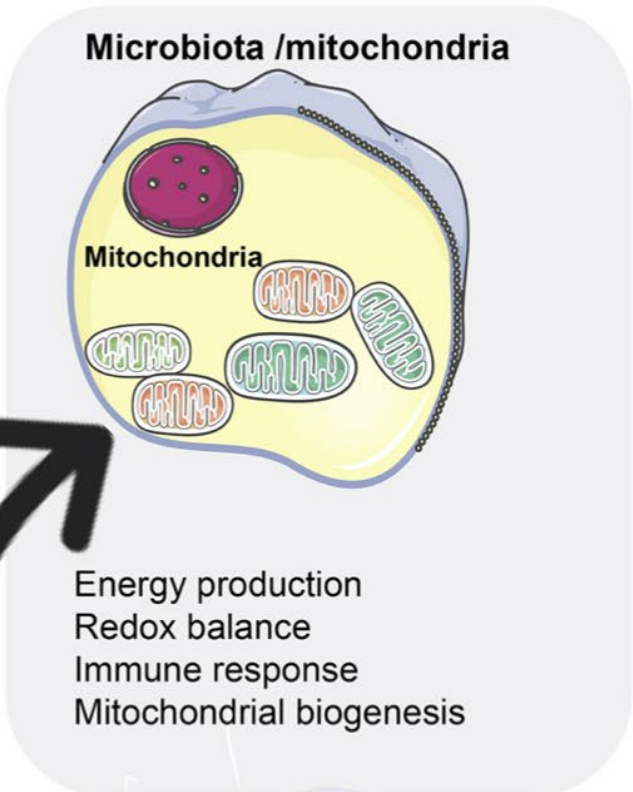
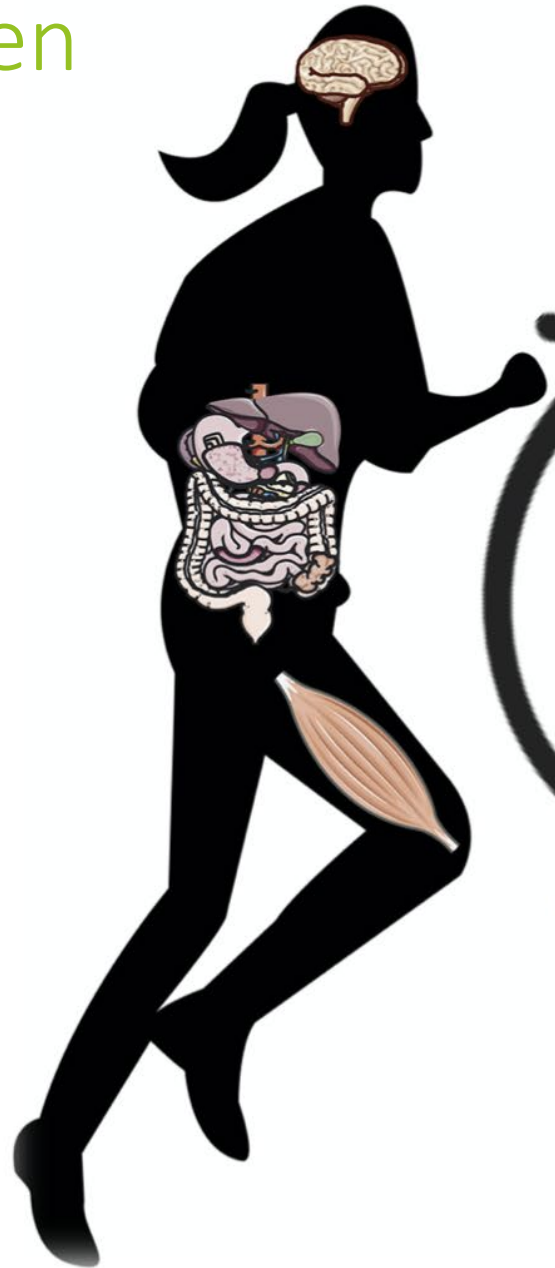
# Kombination und Priorität



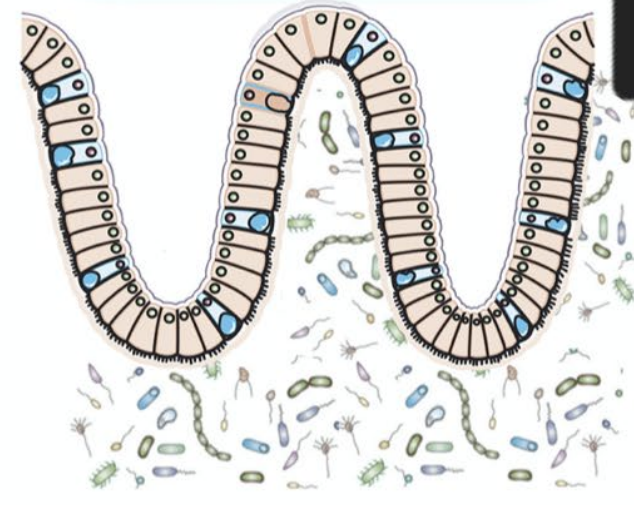
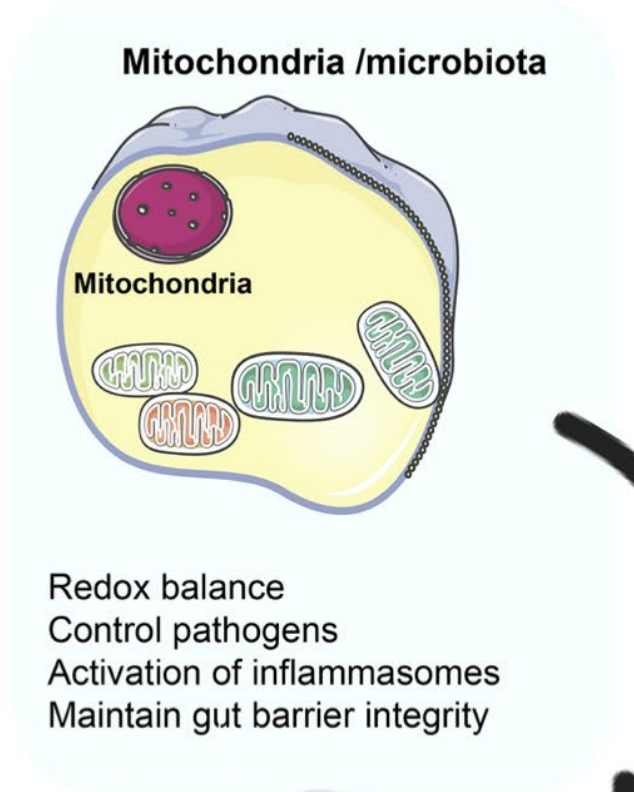
# Bewegen



# Mitochondrien und Mikrobiom

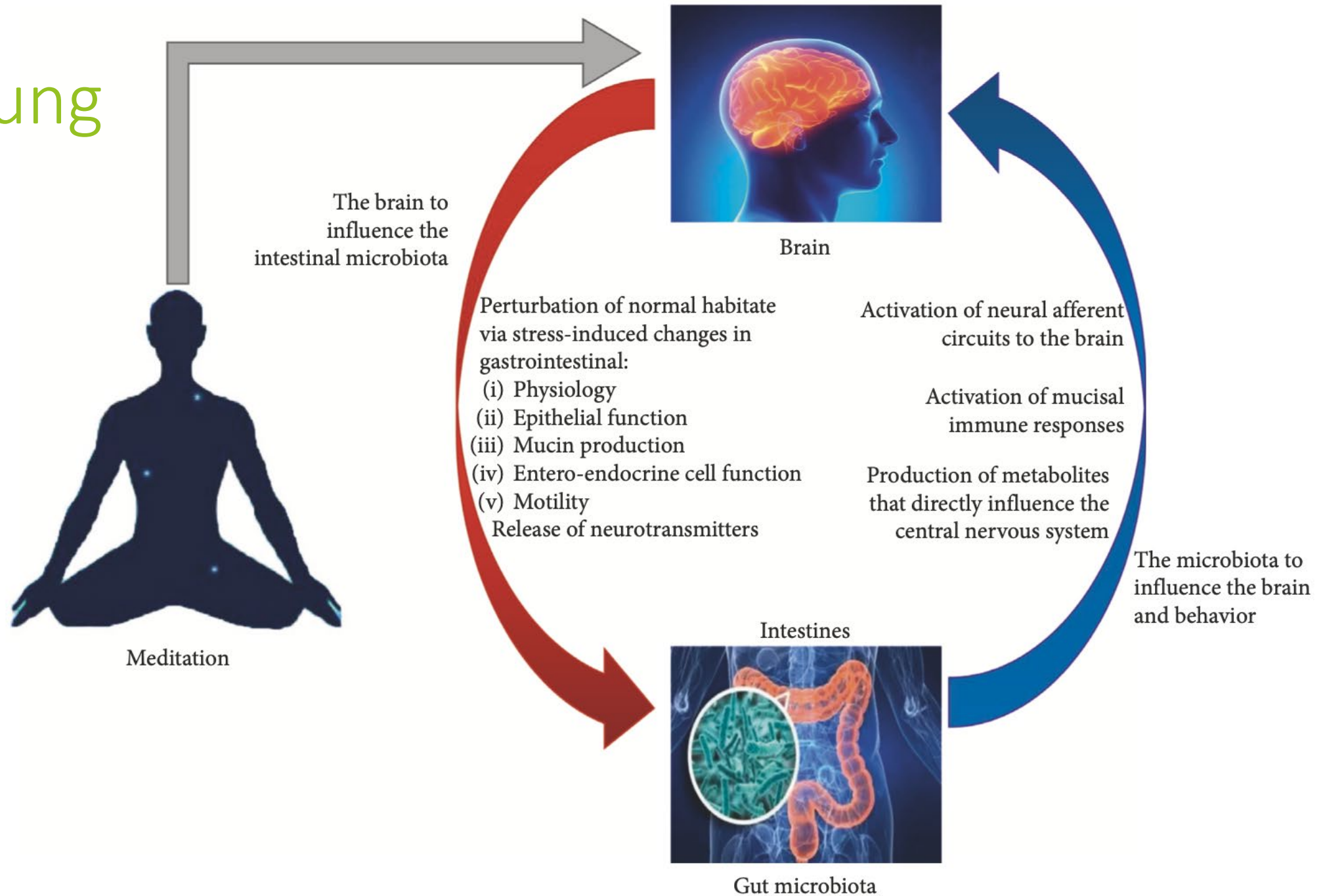


**Commensal bacteria**



**Commensal bacteria**

# Entspannung



# 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