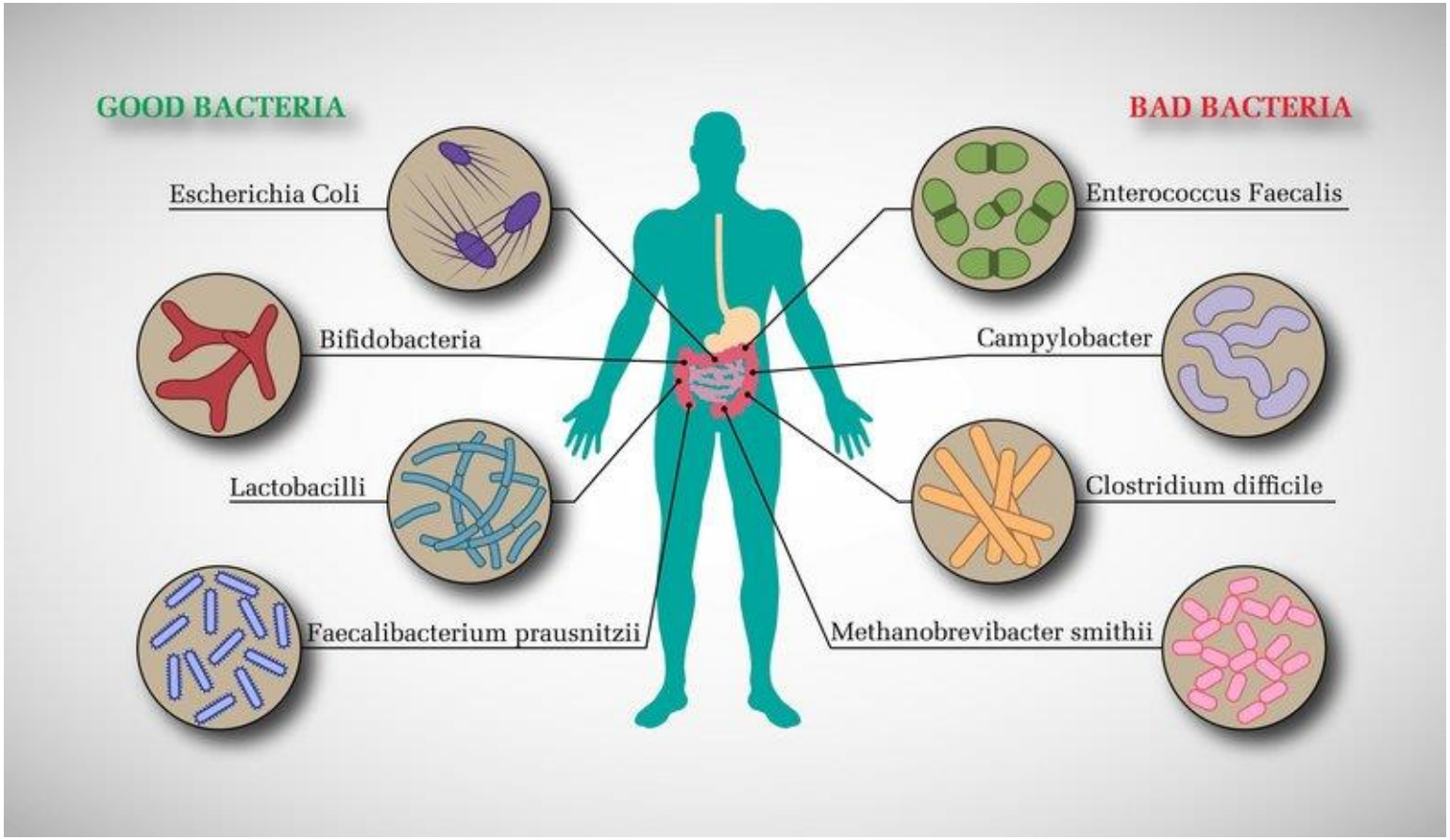
2ND NUTRIAGING SUMMER SCHOOL 2022

# MICROBIOME AND ITS IMPORTANCE IN OLDER AGE

Ing. Patrick A. Zöhrer, BSc BSc MSc

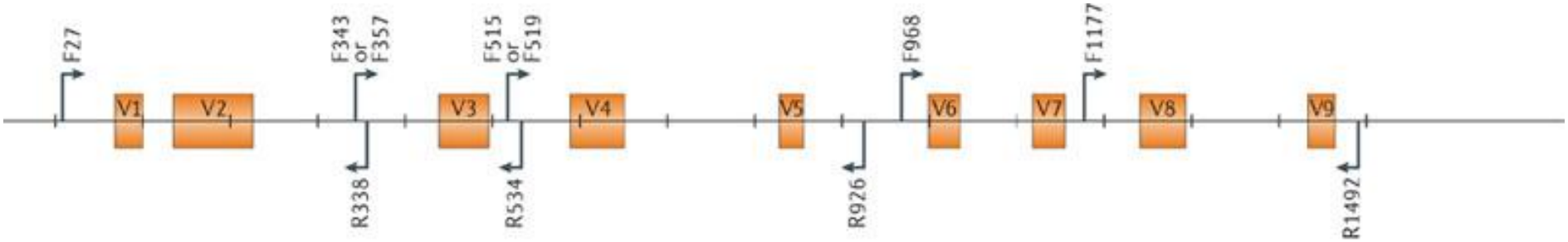
Date of presentation: September 20th 2022

# GUT MICROBIOTA

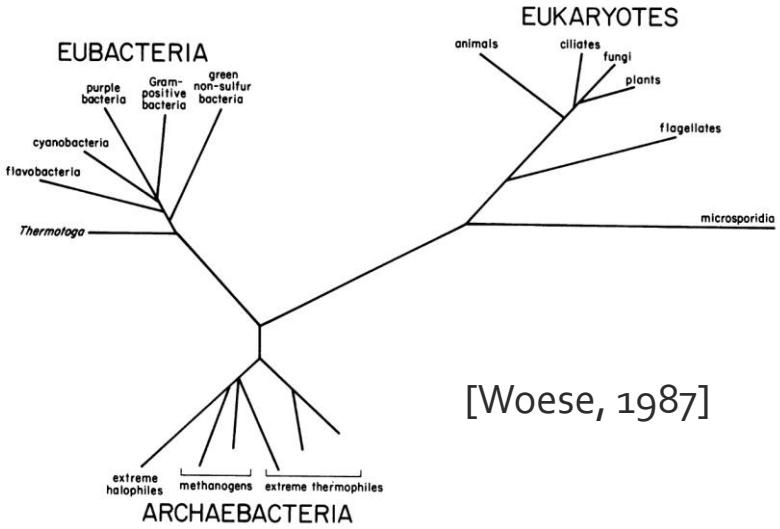



http://image.redbull.com/rbx00516/0010/1/795/460/451/fileadmin/user_upload/images/Blog_2016-01_-_Good_and_Bad_bacterial_flora.jpg

# How to identify organisms $_{or}$ the **16S rRNA gene**




[Kuczynski et al., 2012]

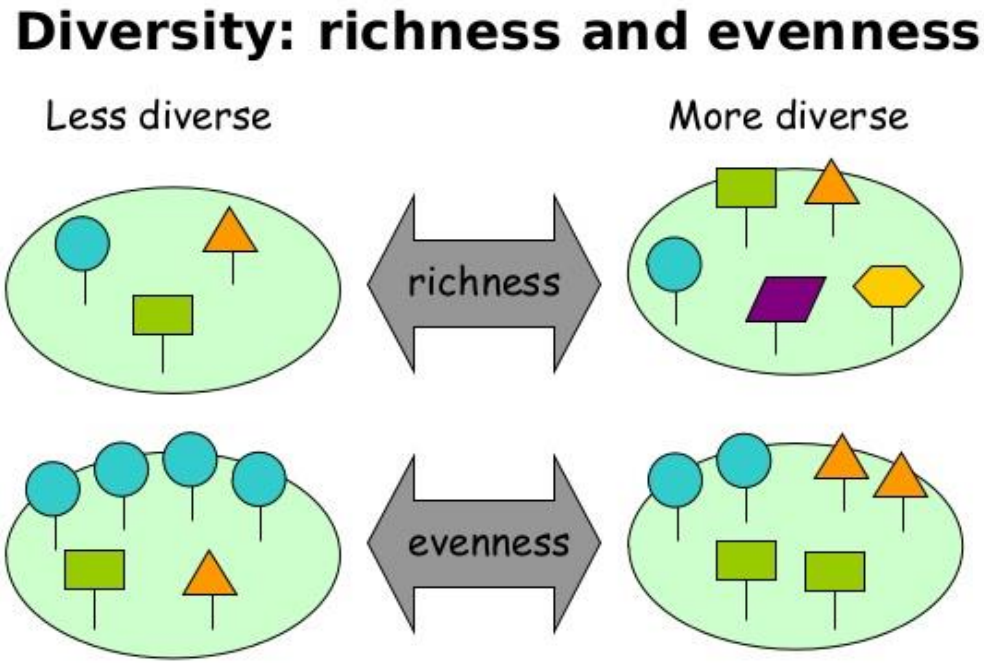



[Woese, 1987]

**Knowing the sequence of the same gene that everybody has, results in a distance tree.**

# α-DIVERSITY

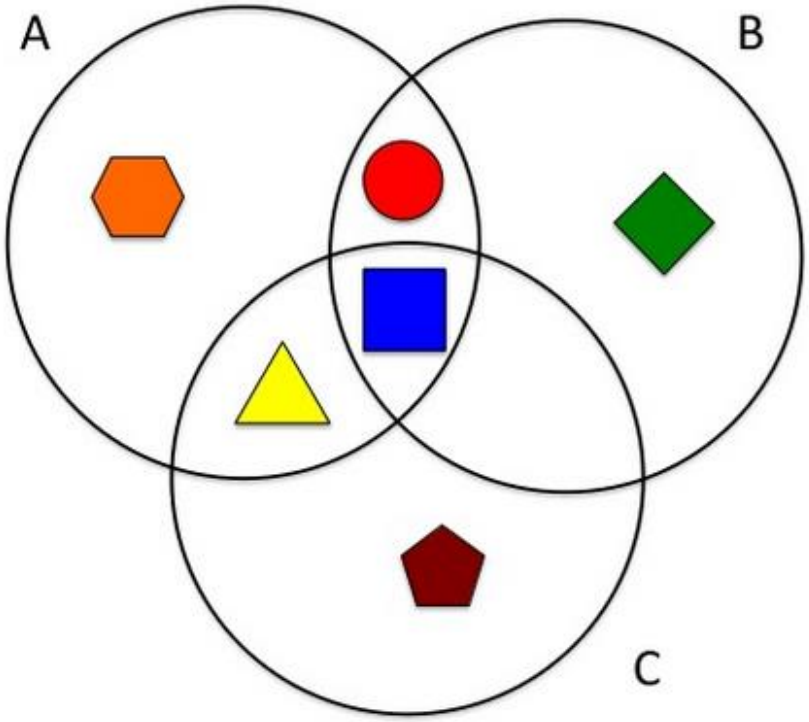
How many different microbial species could be detected in one sample?




https://www.slideshare.net/ForestTreesSentinelL/tree-diversity-analysisapplication-to-sentinel-landscape-data

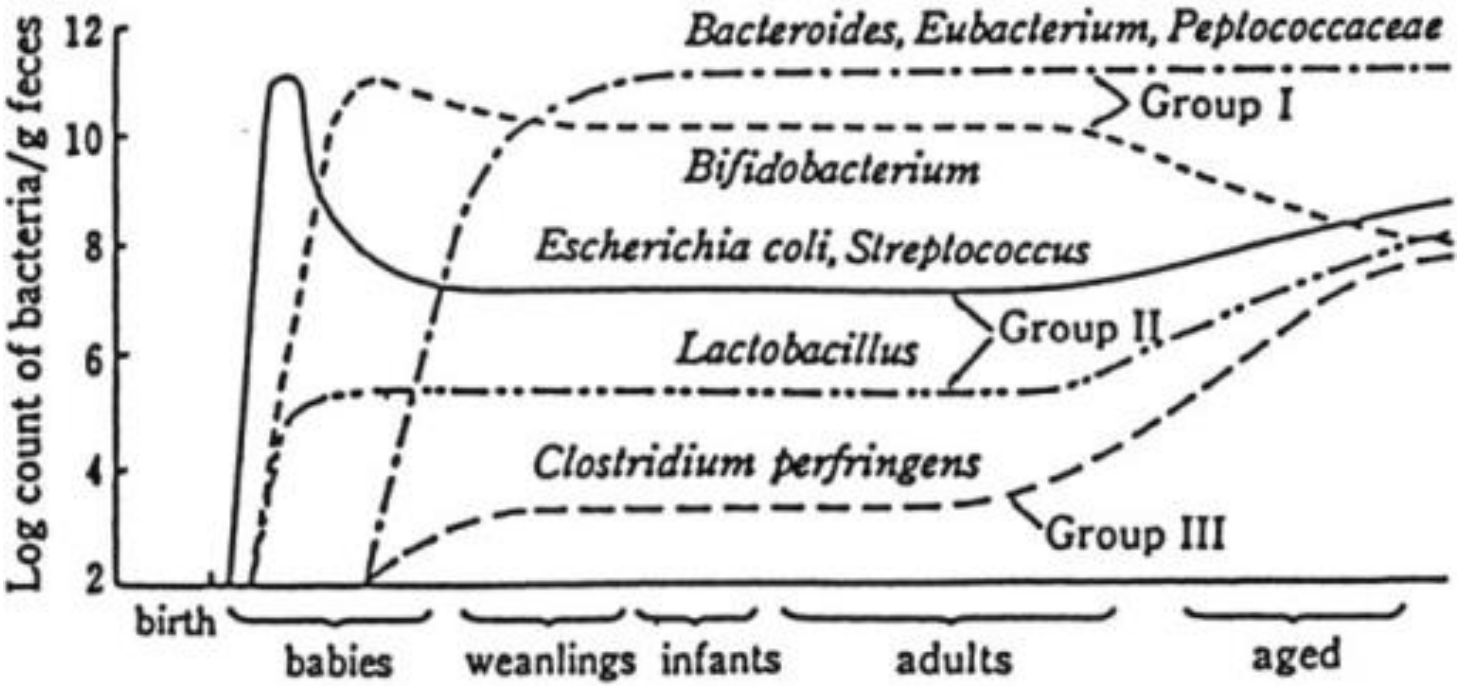
# β-DIVERSITY

How different is the microbial composition in one environment compared to another?




https://www.slideshare.net/mcdonadt/american-gut-project-presentation-at-masaryk-university

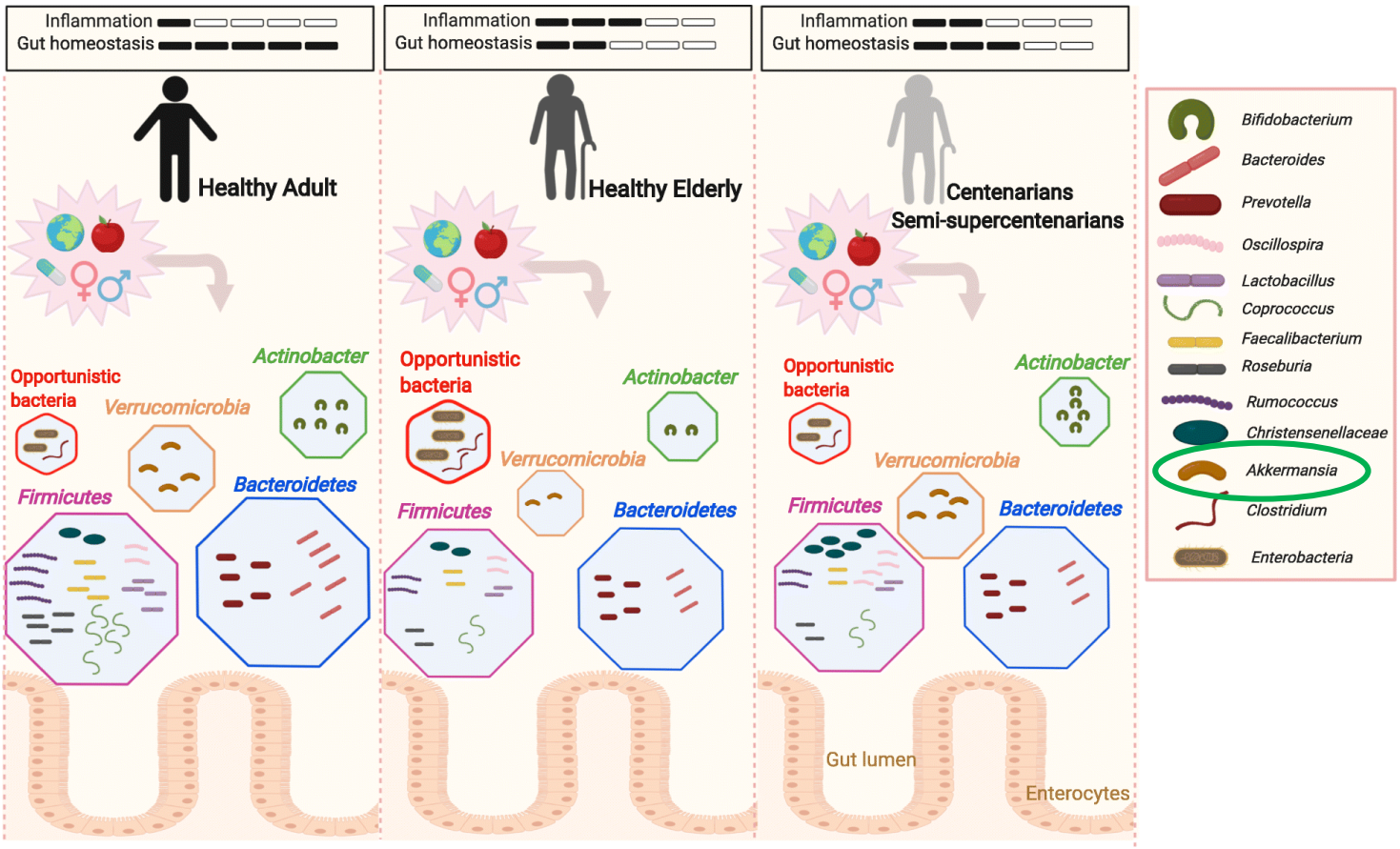
# CHANGES IN FECAL FLORA WITH AGING




- Various changes in the composition of microbiota until the age of 2-5 years
- Stable (core) microbiota up to the age of ~65 years
- Shifts in composition and functionality in older ages

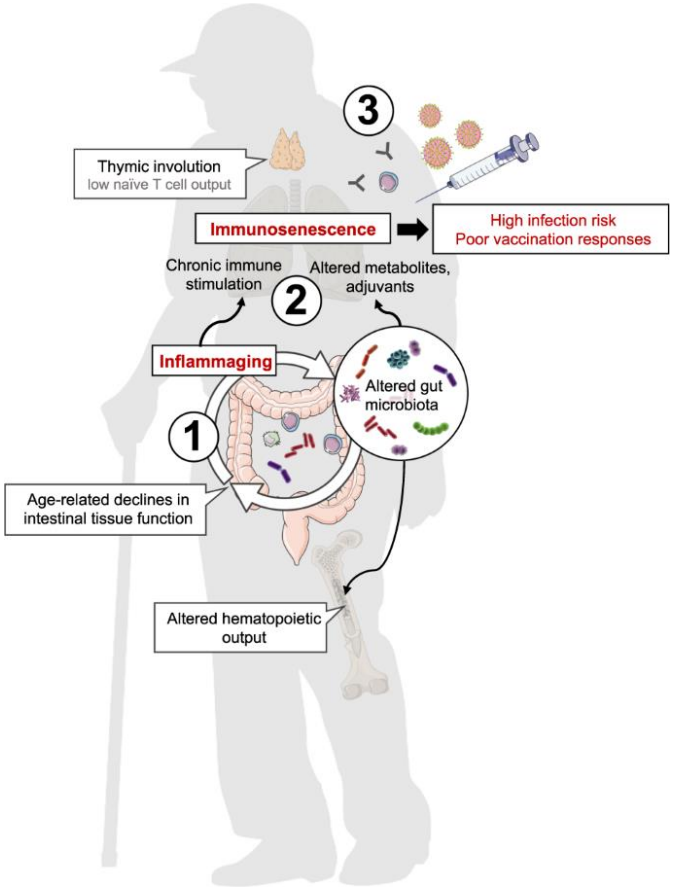
[Mitsuoka, 1978; Skillington et al., 2021]

# CHANGING COMPOSITION OF MICROBIOTA




[Ragonnaud & Biragyn, 2021]

# MICROB-AGING AND CONSEQUENCES



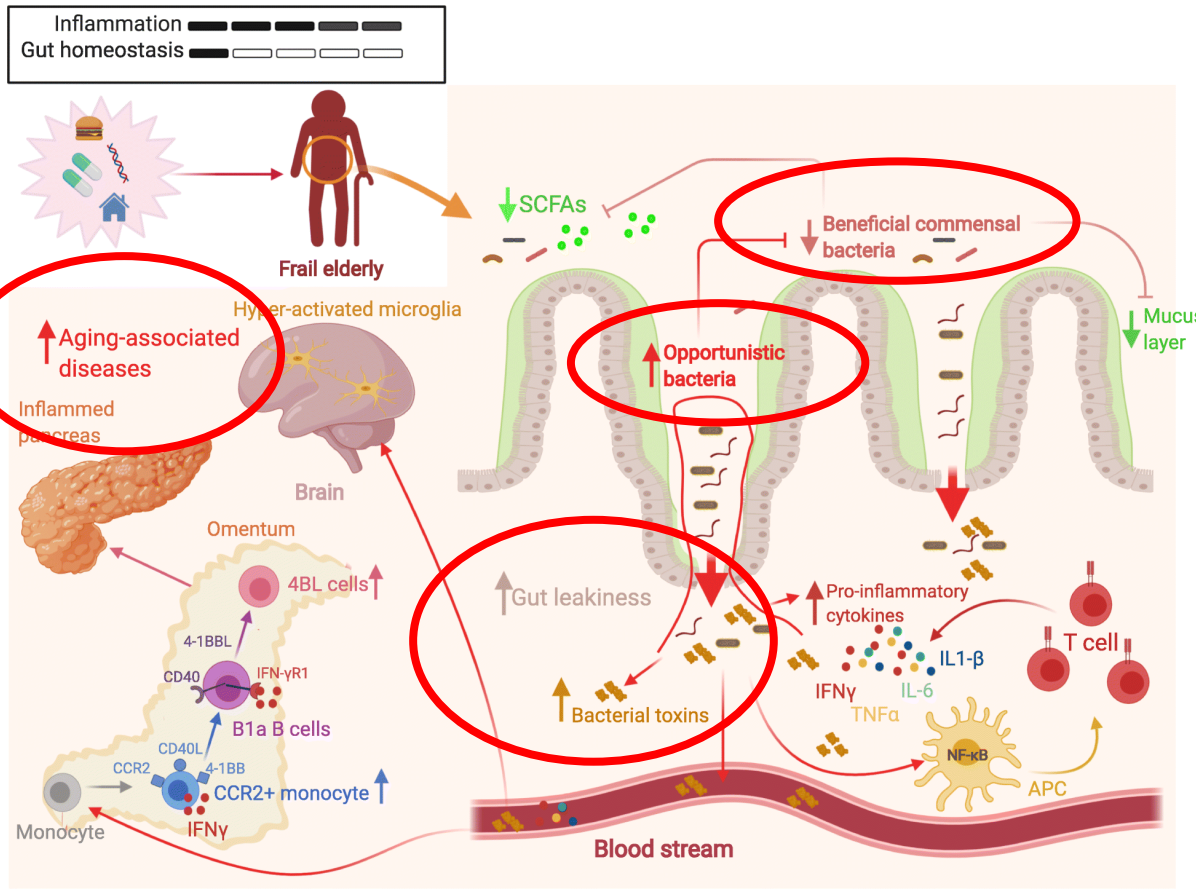

- Dysbiosis
- Loss of diversity
- Microbiota instability
- (Antibiotics)

lead to e.g.

- Increase of gut leakiness
- Increased insulin resistance
- Frailty
- Systemic inflammation

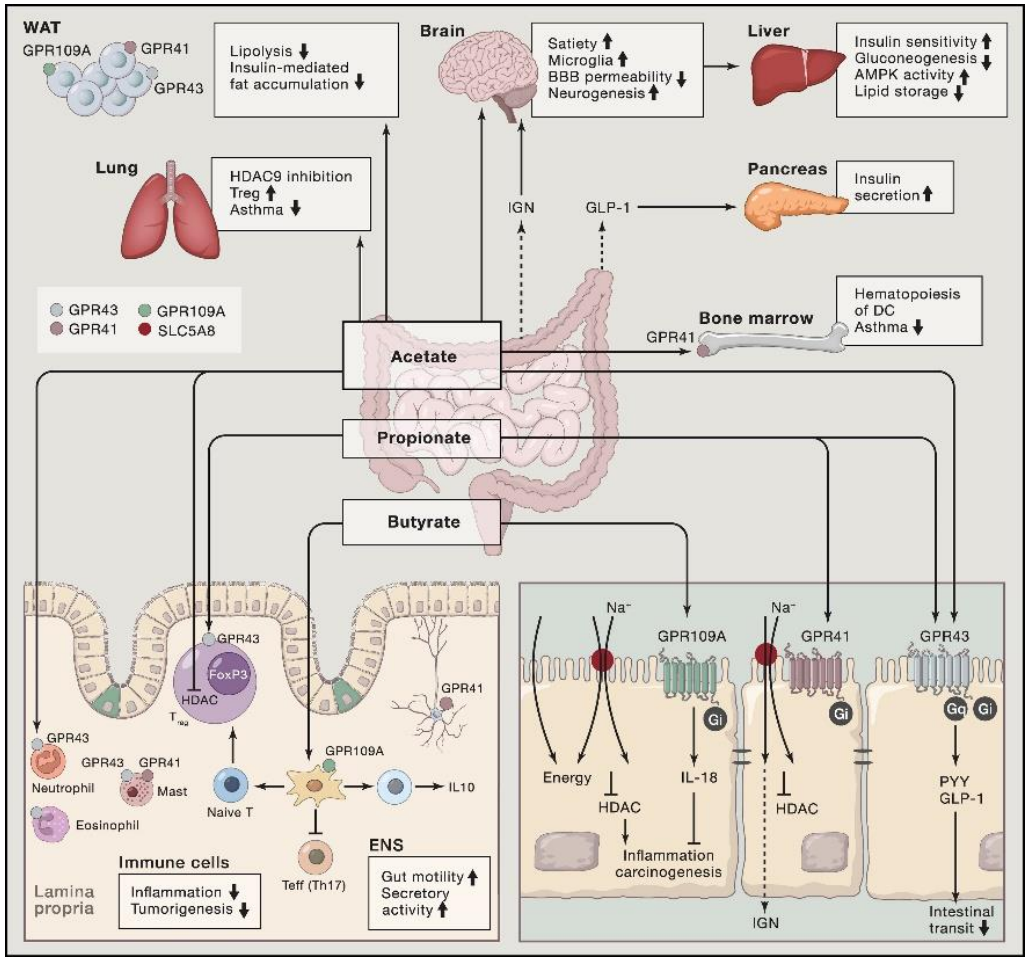
[Bosco & Noti, 2021]

# GUT DYSBIOSIS IN THE ELDERLY



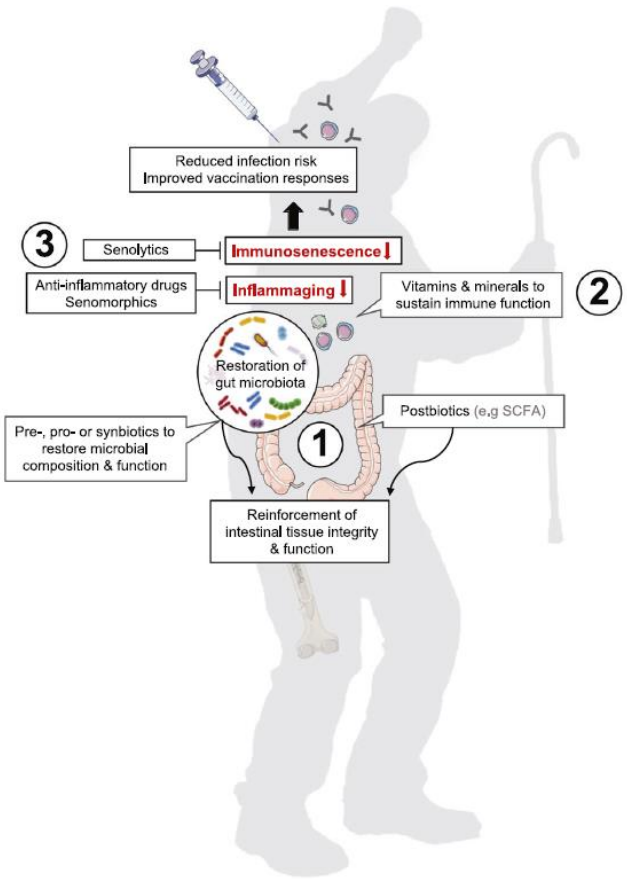

[Ragonnaud & Biragyn, 2021]

# ESSENTIAL EFFECTS OF SCFA




[Koh et al., 2016]

# AIM: RESTORE GUT-MICROBIAL




- Pre- pro- or synbiotics
  - *Akkermansia muciniphila*
- Postbiotics (e.g. SCFAs)
- Supplementation (vitamins, etc.)
- (Medication)
- (Fecal microbiota transplants)

lead to e.g.

- Increase gut barrier integrity
- Reinforce host immunity

[Bosco & Noti, 2021]

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# METHODS Extraction PCR Sequencing Analysis

## 2-step-approach "multiplex-barcoding-PCR" [Herbold et al., 2015]

Escherichia coli strain NBRC 102203 16S ribosomal RNA gene, partial sequence

### Product 1st-step

gct atgcgcgagc tgcctacgg gaggcagcag tggggaatat tgcacaatgg gcgcaagcct gatgcagcca tgccgcgtgt atgaagaagg
ccttcgggtt gtaaagtact ttcagcgggg aggaagggag taaagttaat acctttgctc attgacgtta cccgcagaag aagcaccggc taactccgtg
ccagcagccg cggtaatacg gagggtgcaa gcgttaatcg gaattactgg gcgtaaagcg cacgcaggcg gtttgttaag tcagatgtga aatccccggg
ctcaacctgg gaactgcatc tgatactggc aagcttgagt ctcgtagagg ggggnagaat tccaggtgta gcggtgaaat gcgtagagat ctggaggaat
accggtggcg aaggcggccc cctggacgaa gactgacgct caggtgcgaa agcgtgggga gcaaacagga ttagataccc gcagctcgcg


**Head-Target gene**

**GCTATGCGCGAGCTGCCCTACGGGNGGCWGCAG-3'**

**3'-**

**CCTAATCTATGGGVHCATCAGCGTCGAGCGCGTATCG**

# METHODS Extraction PCR Sequencing Analysis

## 2-step-approach "multiplex-barcoding-PCR" [Herbold et al., 2015]

Escherichia coli strain NBRC 102203 16S ribosomal RNA gene, partial sequence

### Product 2nd-step

gatgacctgct atgcgcgagc tgcctacgg gaggcagcag tggggaatat tgcacaatgg gcgcaagcct gatgcagcca tgccgcgtgt atgaagaagg
ccttcgggtt gtaaagtact ttcagcgggg aggaagggag taaagttaat acctttgctc attgacgtta cccgcagaag aagcaccggc taactccgtg
ccagcagccg cggtaatacg gagggtgcaa gcgttaatcg gaattactgg gcgtaaagcg cacgcaggcg gtttgttaag tcagatgtga aatccccggg
ctcaacctgg gaactgcatc tgatactggc aagcttgagt ctcgtagagg ggggnagaat tccaggtgta gcggtgaaat gcgtagagat ctggaggaat
accggtggcg aaggcggccc cctggacgaa gactgacgct caggtgcgaa agcgtgggga gcaaacagga ttagataccc gcagctcgcg catagctcca
gtag


**Barcode-Head-Target gene**

**5′-GATGACCTGCTATGCGCGAGCTGCCCTACGGGNGGCWGCAG-3′**

**3′-**

**CCTAATCTATGGGVHCATCAGCGTCGAGCGCGTATCGTCCAGTAG-5′**