

# Miksi kannattaa syödä terveellisesti?

Emme ole sitä mitä syömme vaan sitä mitä suoliston bakteerit tekevät siitä mitä syömme!

Pentti Huovinen, emeritusprofessori, tietokirjailija

2.10.2024



TURUN  
YLIOPISTO

# Pentti Huovinen

Professori (emeritus), tietokirjailija, tiedetoimittaja

Dekaani, lääketieteellinen tiedekunta TY, 2014-2019; bakteeriopin professori TY, 2010-2023; ylilääkäri 2019-2023 TYKS Laboratoriot;

Ylilääkäri, tutkimusprofessori, osaston johtaja, päätoimittaja, Kansanterveyslaitos ja THL, 1990-2014

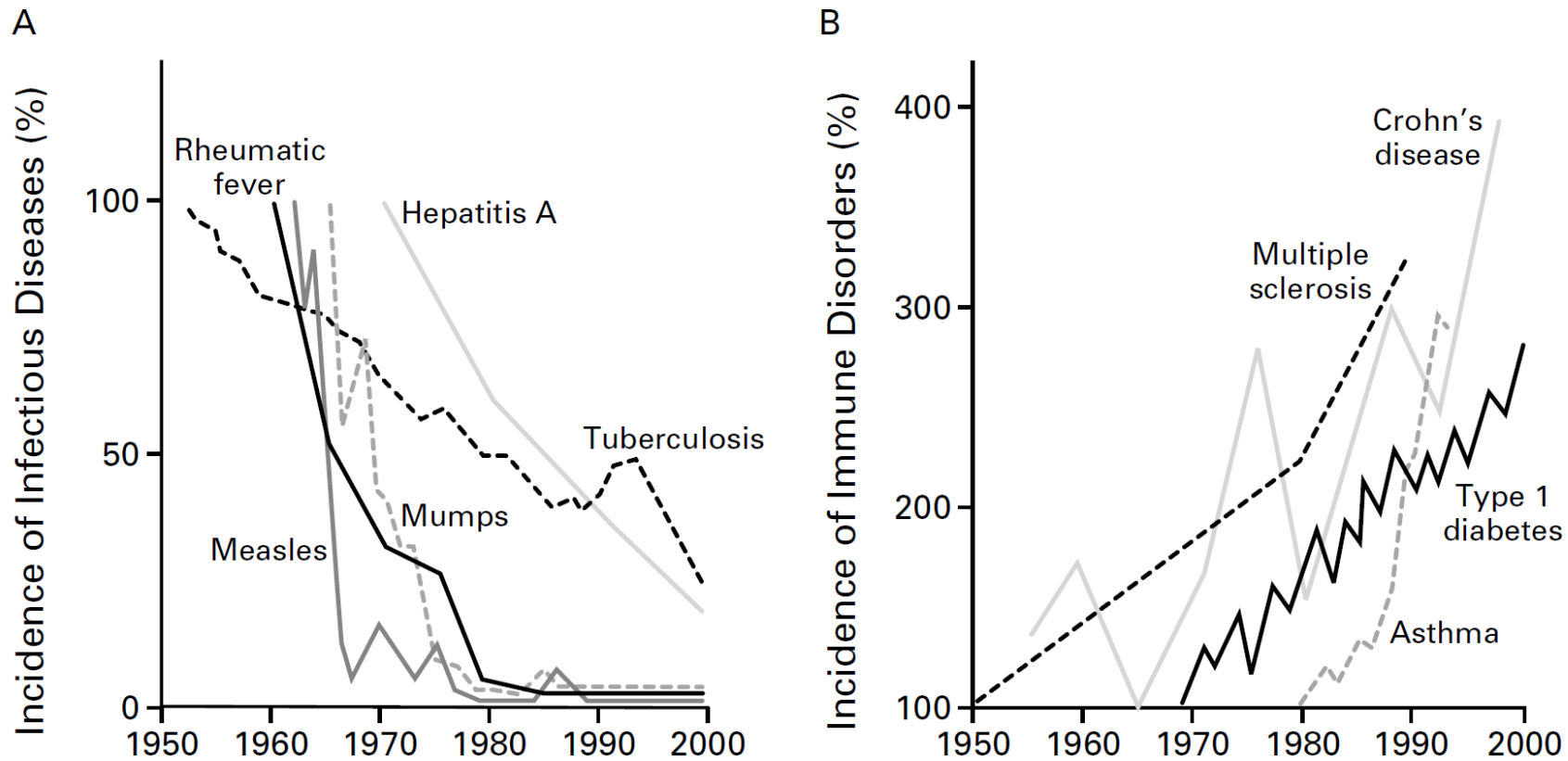
Sakari Alhopurosäätiön hallituksen jäsen (2019-), puheenjohtaja (2023-)

Research Fellow in Medicine, Harvard Medical School and Massachusetts General Hospital, Boston, USA, 1986-1987; Executive Development Program, Wharton School, University of Pennsylvania, 2003

Award of Excellence, European Society for Clinical Microbiology and Infectious Diseases, 2009; Tiedonjulkistamisen valtionpalkinto, 2008; Tietokirjailijoiden Antero Wareljus –palkinto 2012; A.I. Virtanen -palkinto 2021

## **Sidonnaisuudet:**

WSOY, Suomen Lääkärilehti ja Kustannus Oy Duodecim (*tekijänpalkkiot*); Biocodex, Kabi Fresenius, Biogen, Pfizer (*asiantuntija- ja luentopalkkiot*); Referator Oy (*toimitusjohtaja*), Onnettomuustutkintakeskus (*asiantuntija*)



**Figure 1.** Inverse Relation between the Incidence of Prototypical Infectious Diseases (Panel A) and the Incidence of Immune Disorders (Panel B) from 1950 to 2000.

In Panel A, data concerning infectious diseases are derived from reports of the Centers for Disease Control and Prevention, except for the data on hepatitis A, which are derived from Joussemet et al.<sup>12</sup> In Panel B, data on immune disorders are derived from Swarbrick et al.,<sup>10</sup> Dubois et al.,<sup>13</sup> Tuomilehto et al.,<sup>14</sup> and Pugliatti et al.<sup>15</sup>

# Bakteeriston koostumukseen vaikuttavat mm.

Perimä

Äidin ja isän bakteeristo

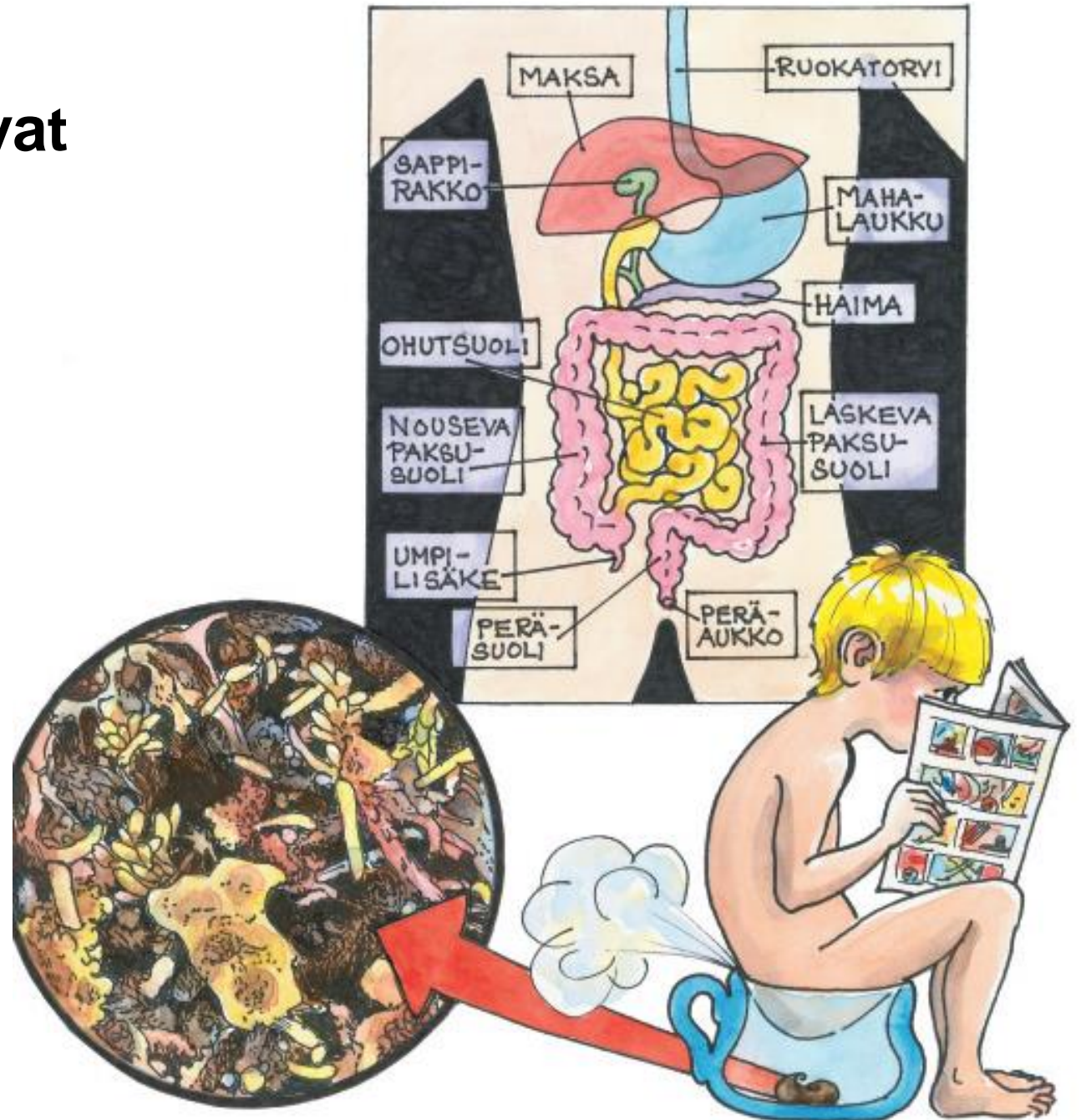
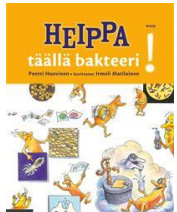
Lääkkeet, antibiootit

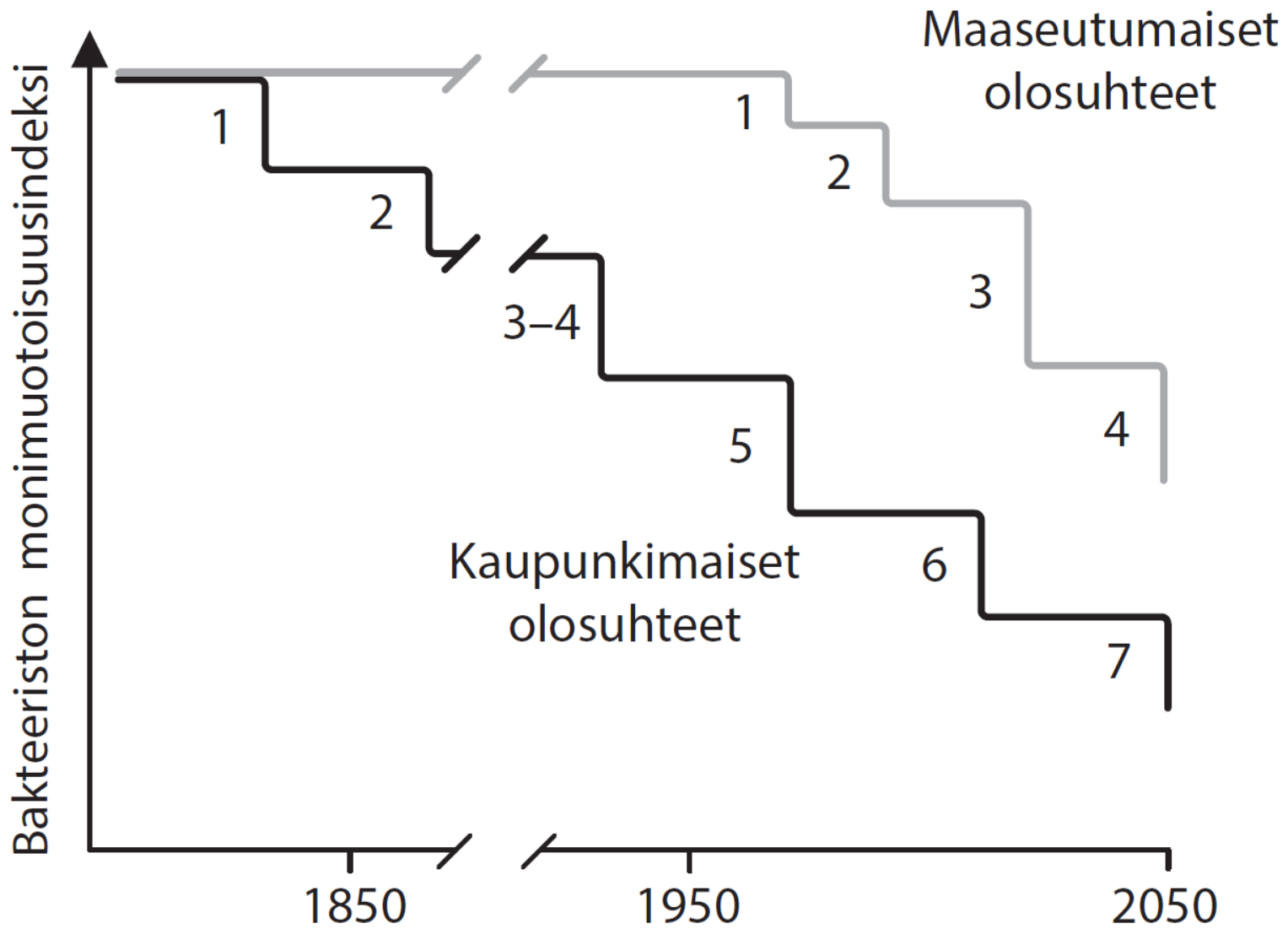
Infektiotaudit

Hygieniset olosuhteet

Ikä

Kuva: Huovinen P, Matilainen I  
Heippa – täällä bakteeri,  
WSOY 2007





Pentti Huovinen: Parantavat bakteerit, WSOY 2021

# Kolme tärkeää tekijää

## 1. Dysbioosi – elimistön tulehdusreaktio

- Kuinka välttää tulehdusreaktion?

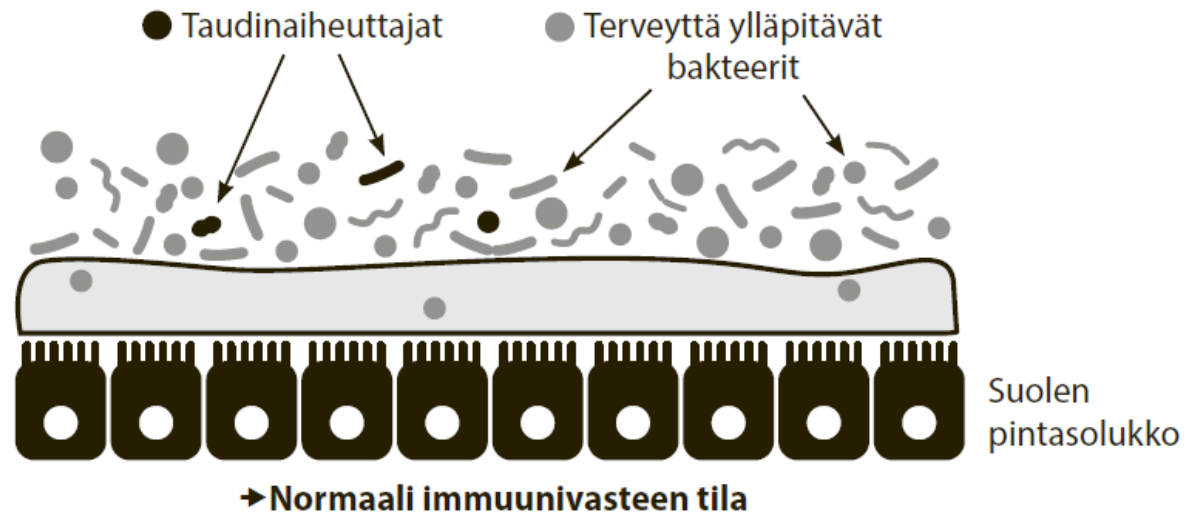
## 2. Oikeanlainen ravinto

- Kuinka ruokkia terveyttä edistäviä mikrobeja?

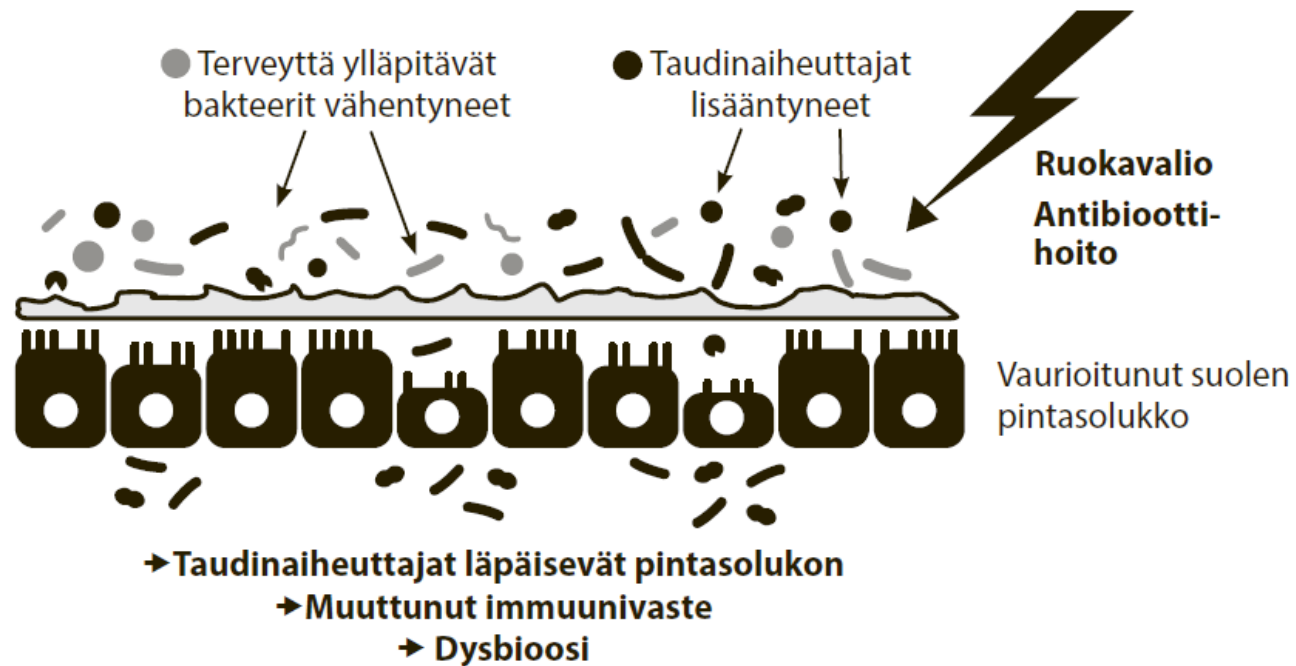
## 3. Lajirikas bakteeristo

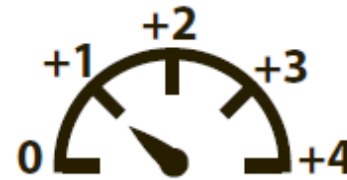
- Mistä ja miten saada terveyttä edistäviä bakteereita?

## A. TERVE BAKTEERISTO



## B. SAIRAS BAKTEERISTO



	Vähärasvainen	Rasvainen	Rasvainen ja vähärasvainen
Dieetti			
Tulehdusreaktio			
Luuytimen muistisolut			





# Länsimainen ruokavalio ja tulehdussairaudet

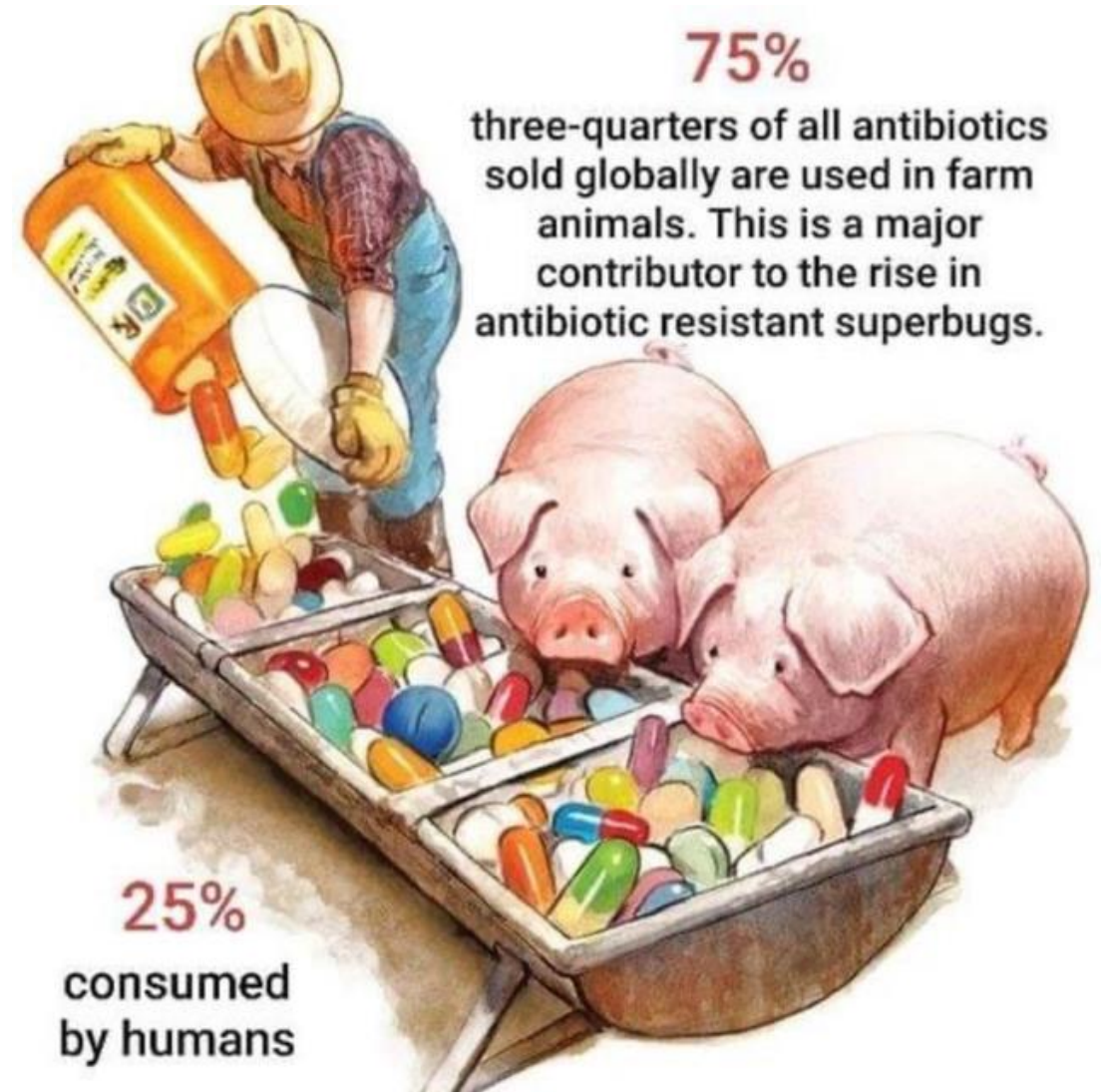
Sairaus	Havaittu muuttunut suoliston bakteeristo <b>ihmisellä</b>	Estettävissä ruokavalion muutoksella <b>hiirillä</b>
Lihavuus	x	x
Tyypin 1 diabetes	x	x
Tyypin 2 diabetes	x	x
Sydän- ja verisuonitaudit	x	x
Valtimotauti (ateroskleroosi)	x	?
Rasvamaksa	x	x
Nivelreuma	x	x
Alzheimerin tauti	x	x
Multippeliskleroosi	x	?
Autismi	x	?
Ruoka-aineallergiat	x	x
Astma	x	x
Suolisyöpä	x	x

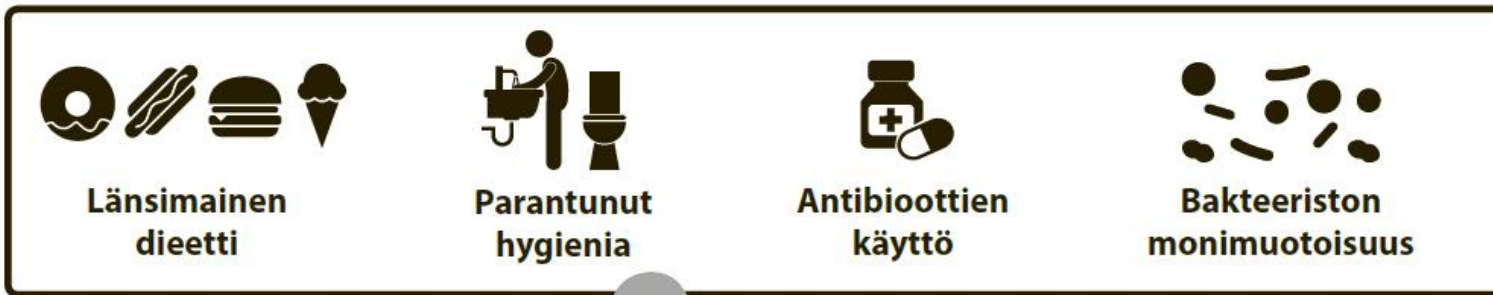
## ANTIBIOOTTIEN KÄYTÖN EKOLOGISET VAIKUTUKSET

(50–100 miljardia annosta  
vuodessa maailmassa)

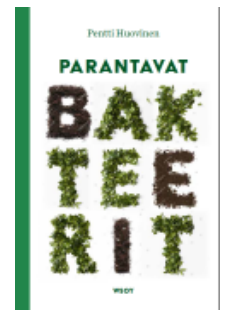
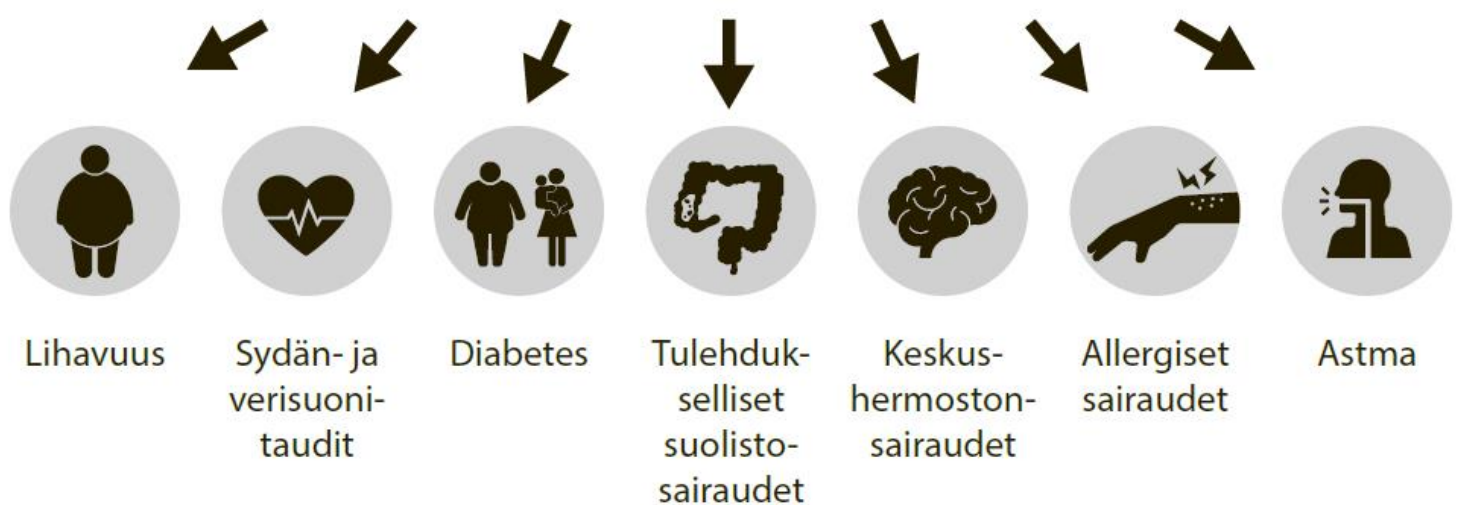
**Bakteerien vastustuskyky  
antibiooteille lisääntyy**

**Dysbioosin ja  
bakteeriston  
muutosten  
aiheuttamat  
sairaudet**





**Dysbioosi**



# Diseases linked to **Chronic Inflammation**

When you have chronic inflammation, your body is in a constant state of high alert. The release of inflammatory chemicals can affect many different systems in your body and be a cause or consequence of multiple diseases.

## **EYES**

Macular degeneration, retinal degeneration, uveitis

## **HEART AND BLOOD VESSELS**

Atherosclerosis (hardening of the arteries), heart disease

## **LUNGS**

Allergies, asthma, COPD, lung cancer

## **LIVER**

Chronic hepatitis

## **DIGESTIVE SYSTEM**

Inflammatory bowel disease, including Crohn's disease and ulcerative colitis

## **SKIN**

Acne, eczema, skin cancer

## **BRAIN AND SPINAL CORD**

Alzheimer's disease, multiple sclerosis, Parkinson's disease

## **THYROID**

Thyroiditis

## **PANCREAS**

Type 1 diabetes

## **KIDNEYS**

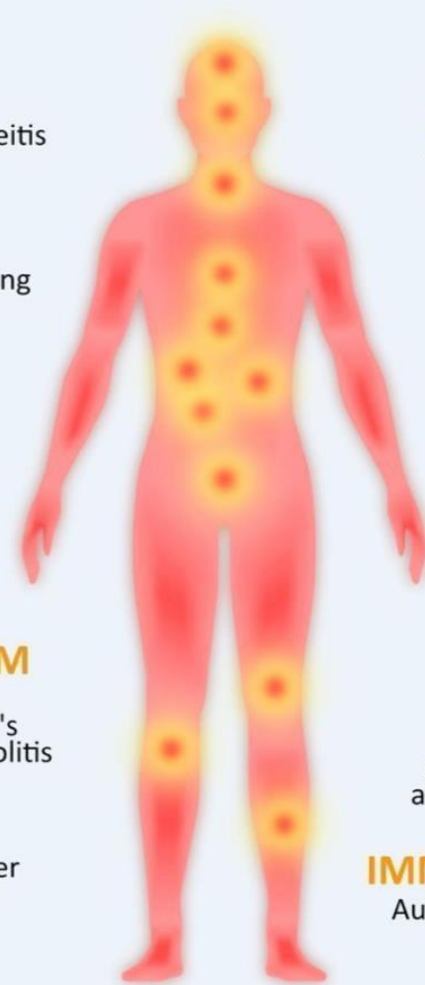
Chronic kidney disease, kidney failure, nephritis

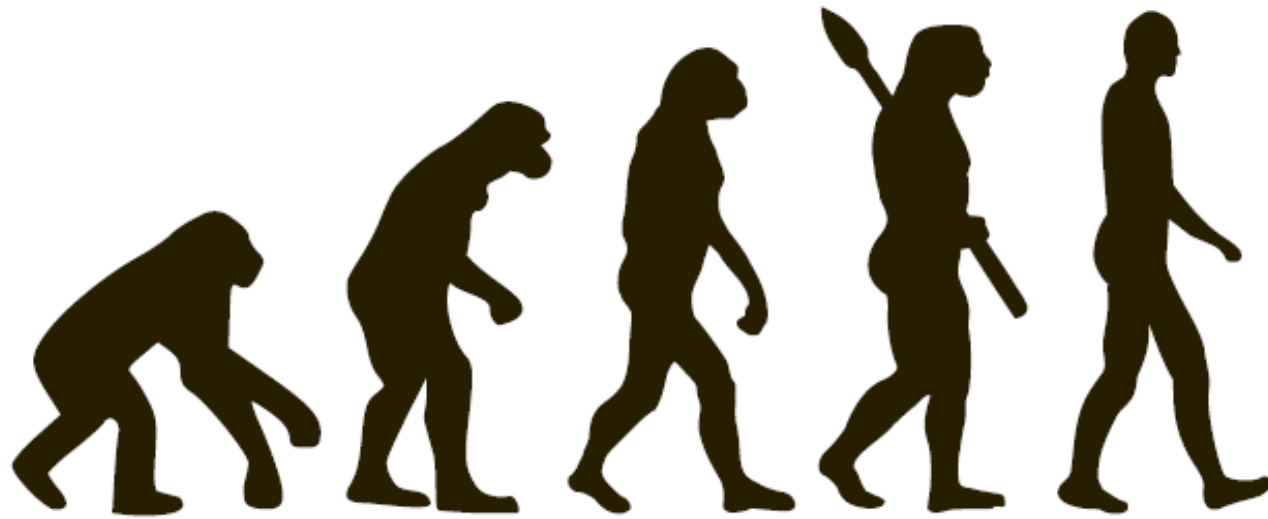
## **JOINTS**

Some forms of arthritis, including rheumatoid arthritis and psoriatic arthritis

## **IMMUNE SYSTEM**

Autoimmune disorders such as lupus

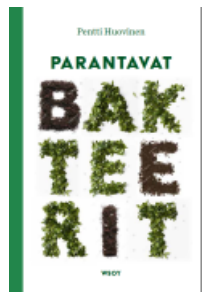




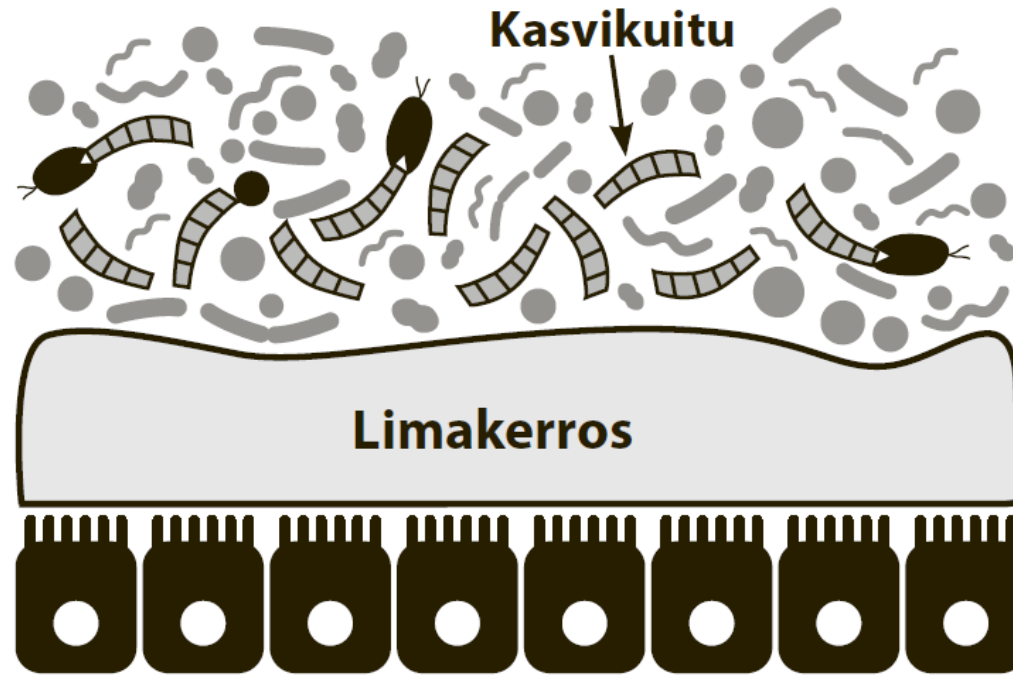
↑  
**Kuiturikas  
ruokavalio**

↑  
**~150 g  
kuitua/päivä**

↑  
**~20 g  
kuitua/päivä**

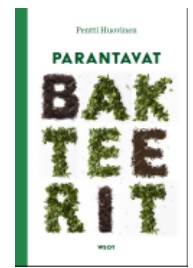
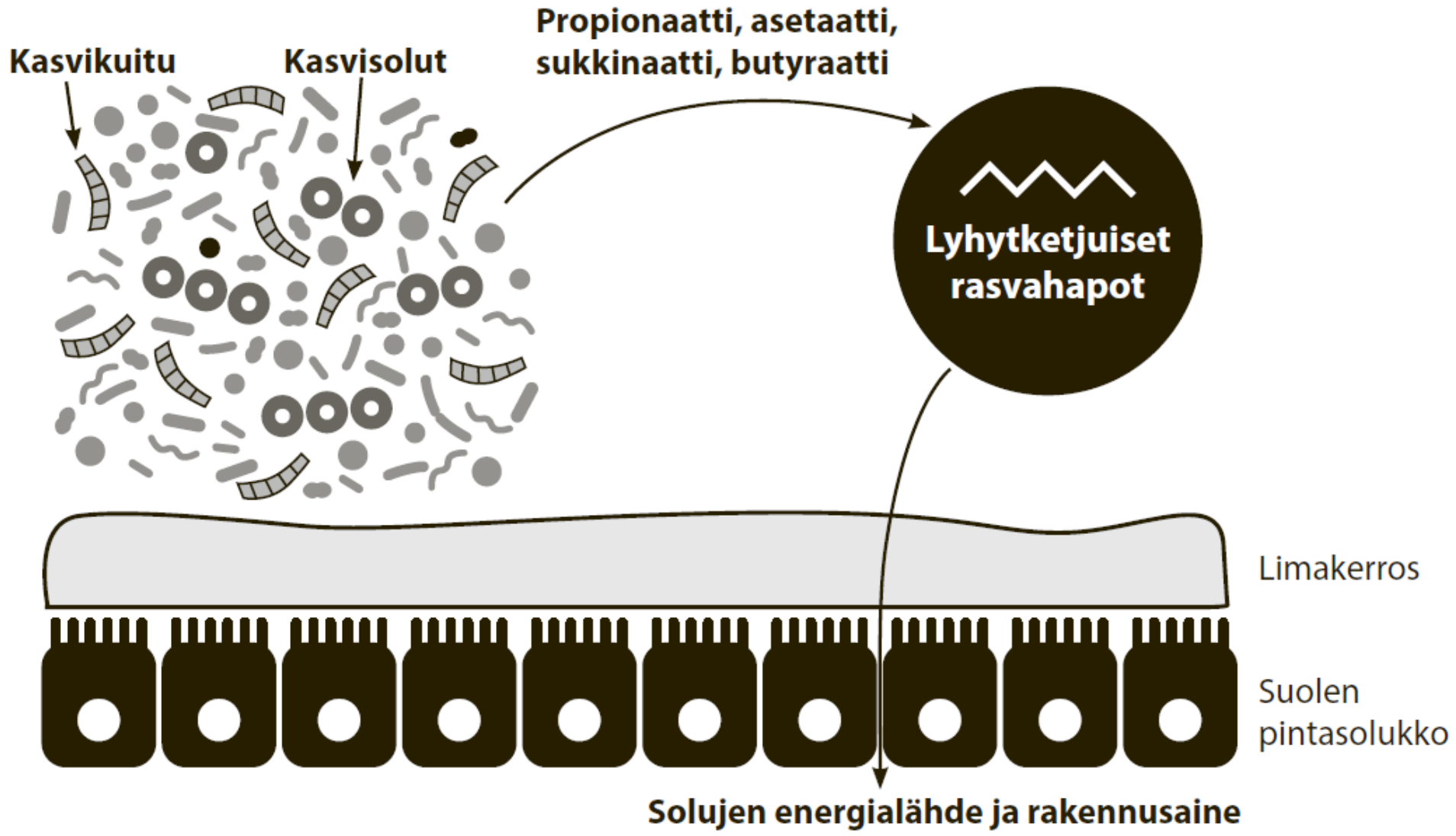


A.

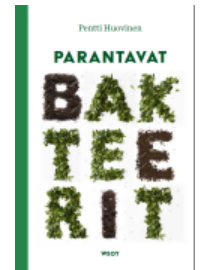


B.





# Ruokakolmio





## Effects of microbiota-directed foods in gnotobiotic animals and undernourished children



A malnourished child in Bangladesh will get special food supplements to help recover.

Riisi-maitojauhepohjainen ravinto vaihdettiin papu-pähkinä-banaani-soija –pohjaiseen ravintoon

15 bakteerilajin tunnistettiin vaikuttavan lasten kasvuun

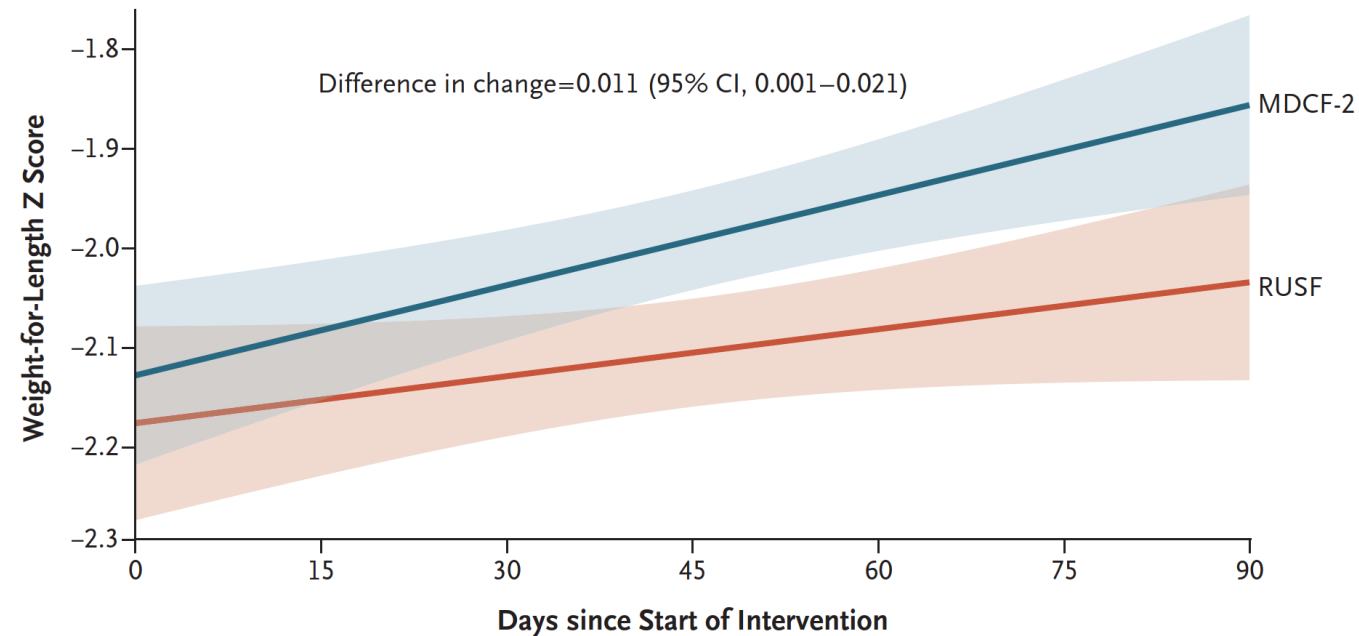
**CONCLUSION:** These findings demonstrate the translatability of results obtained from pre-clinical gnotobiotic animal models to humans, directly support the hypothesis that healthy microbiota development is causally linked to healthy growth, illustrate an approach for treating childhood undernutrition, and with the capacity to deliberately reconfigure immature microbiota, suggest a means to decipher how elements of the gut microbial community operate to regulate various host systems involved in healthy growth. ■

# A Microbiota-Directed Food Intervention for Undernourished Children

Robert Y. Chen, B.S., Ishita Mostafa, B.D.S., M.P.H., Matthew C. Hibberd, Ph.D., Subhasish Das, M.B., B.S., M.P.H., Mustafa Mahfuz, M.B., B.S., M.P.H., Nurun N. Naila, M.B., B.S., M.P.H., M. Munirul Islam, M.B., B.S., Ph.D., Sayeeda Huq, M.B., B.S., M.P.H., M. Ashraful Alam, M.P.H., Mahabub U. Zaman, M.P.H., Arjun S. Raman, M.D., Ph.D., Daniel Webber, M.D., Ph.D., Cyrus Zhou, B.S., Vinaik Sundaresan, B.S., Kazi Ahsan, M.B., B.S., M.P.H., Martin F. Meier, B.S., Michael J. Barratt, Ph.D., Tahmeed Ahmed, M.B., B.S., Ph.D., and Jeffrey I. Gordon, M.D.

N ENGL J MED 384;16 NEJM.ORG APRIL 22, 2021

## B Weight-for-Length Measure



**Microbiome-based therapeutics**

**Faecal microbiota transplantation**

- Transfer of faeces or complex communities derived by in vitro culture or purification of spores
- Demonstrated efficacy for treatment of recurrent *Clostridioides difficile* infections
- Advantages: transfer of intact community, proven efficacy in clinic
- Challenges: screening of donor samples, scalability, potential variability in efficacy depending on donor

**Diet and prebiotics**

- Supplementation of microbiota-targeted substrates, such as specific dietary fibres to promote a desired compositional changes in the microbiota, or production of a desired metabolite
- Advantages: relatively easy to prepare, safety
- Challenges: predicting outcomes of supplementation across different microbiota compositions, length of impact following supplementation, targeted species or activities must be present

**Symbiotic microbial consortia**

- Transfer of a group of isolates, selected or designed to promote specific microbiota functions
- Advantages: known composition of consortia, individual isolates and potentially self-sustaining community can be screened for safety
- Challenges: isolate selection, replicating phenotypes emerging from complex bacterial interactions, growing desired isolates in culture

**Engineered symbiotic bacteria**

- Transfer of bacteria that colonize the targeted site and are engineered to have a desired function or deliver a desired product or metabolite
- Advantages: potential for producing desired metabolites or compounds in the correct location using a platform strain background that could be engineered for multiple purposes
- Challenges: limited ability to manipulate many species of the microbiota, have to demonstrate safety of modifications

**Microbiota-derived proteins and metabolites**

- Direct supplementation with beneficial proteins or metabolites
- Advantages: relatively easy to prepare, assess safety, likely to follow conventional pharmaceutical development pathways
- Challenges: determining and delivering adequate concentrations to desired site

Microbiome-based therapeutics

Matthew T. Sorbara and Eric G. Pamer

NATURE REVIEWS | MICROBIOLOGY

<https://doi.org/10.1038/s41579-021-00667-9>

Published online: 06 January 2022

Fig. 1 | **Classes of microbiome-based therapeutics.** The crucial roles the microbiome has in host health has generated

It's not you. It's your level of *Akkermansia*.



PRODUCT BEKIJKEN




## LETTERS

<https://doi.org/10.1038/s41591-019-0495-2>

nature  
medicine

# Supplementation with *Akkermansia muciniphila* in overweight and obese human volunteers: a proof-of-concept exploratory study

Clara Depommier<sup>1,9</sup>, Amandine Everard<sup>1,9</sup>, Céline Druart<sup>1</sup>, Hubert Plovier<sup>1</sup>, Matthias Van Hul<sup>1</sup>, Sara Vieira-Silva <sup>2,3</sup>, Gwen Falony<sup>2,3</sup>, Jeroen Raes<sup>2,3</sup>, Dominique Maiter<sup>4,5</sup>, Nathalie M. Delzenne<sup>6</sup>, Marie de Barsey<sup>4,5,10</sup>, Audrey Loumaye<sup>4,5,10</sup>, Michel P. Hermans<sup>4,5,10</sup>, Jean-Paul Thissen<sup>4,5,10</sup>, Willem M. de Vos <sup>7,8,10</sup> and Patrice D. Cani <sup>1\*</sup>



TURUN  
YLIOPISTO

# *Akkermansia muciniphila*: paradigm for next-generation beneficial microorganisms

Patrice D. Cani<sup>1</sup>✉, Clara Depommier<sup>1</sup>, Muriel Derrien<sup>2</sup>, Amandine Everard<sup>1</sup> and Willem M. de Vos<sup>3,4</sup>

NATURE REVIEWS | **GASTROENTEROLOGY & HEPATOLOGY** | VOLUME 19 | OCTOBER 2022 |

## Key points

- A lower abundance of *Akkermansia muciniphila* has been associated with multiple diseases in both mouse models and in humans.
- *A. muciniphila* has proven efficacy to improve obesity, type 2 and type 1 diabetes mellitus, hepatic steatosis, intestinal inflammation and different cancers (colon cancer, response to immune checkpoints) in mice.
- Numerous mechanisms linking *A. muciniphila*, specific metabolites or membrane proteins and host cell types or receptors have been identified.
- Pasteurized *A. muciniphila* Muc<sup>T</sup> is more efficient than the live bacterium and has proven safety and efficacy in numerous studies in mice and in a proof-of-concept study in humans.
- *A. muciniphila* contributes to the maintenance of a healthy gut barrier, thereby regulating immunity, and also limits the onset of inflammation, which is the root cause of numerous diseases.



### Gut

↑ Gut barrier

- Mucus production
- Goblet cell numbers
- Antimicrobial peptides
- Tight junction proteins



### Systemic

↑ Immunity

↓ Body weight



### Adipose tissue

↓ Fat mass

↓ Inflammation



### Brown adipose

↑ Thermogenesis



### Mitochondria

↑  $\beta$ -oxidation



### Blood

↓ Plasma glucose levels

↓ Plasma cholesterol levels

↓ Plasma triglyceride levels



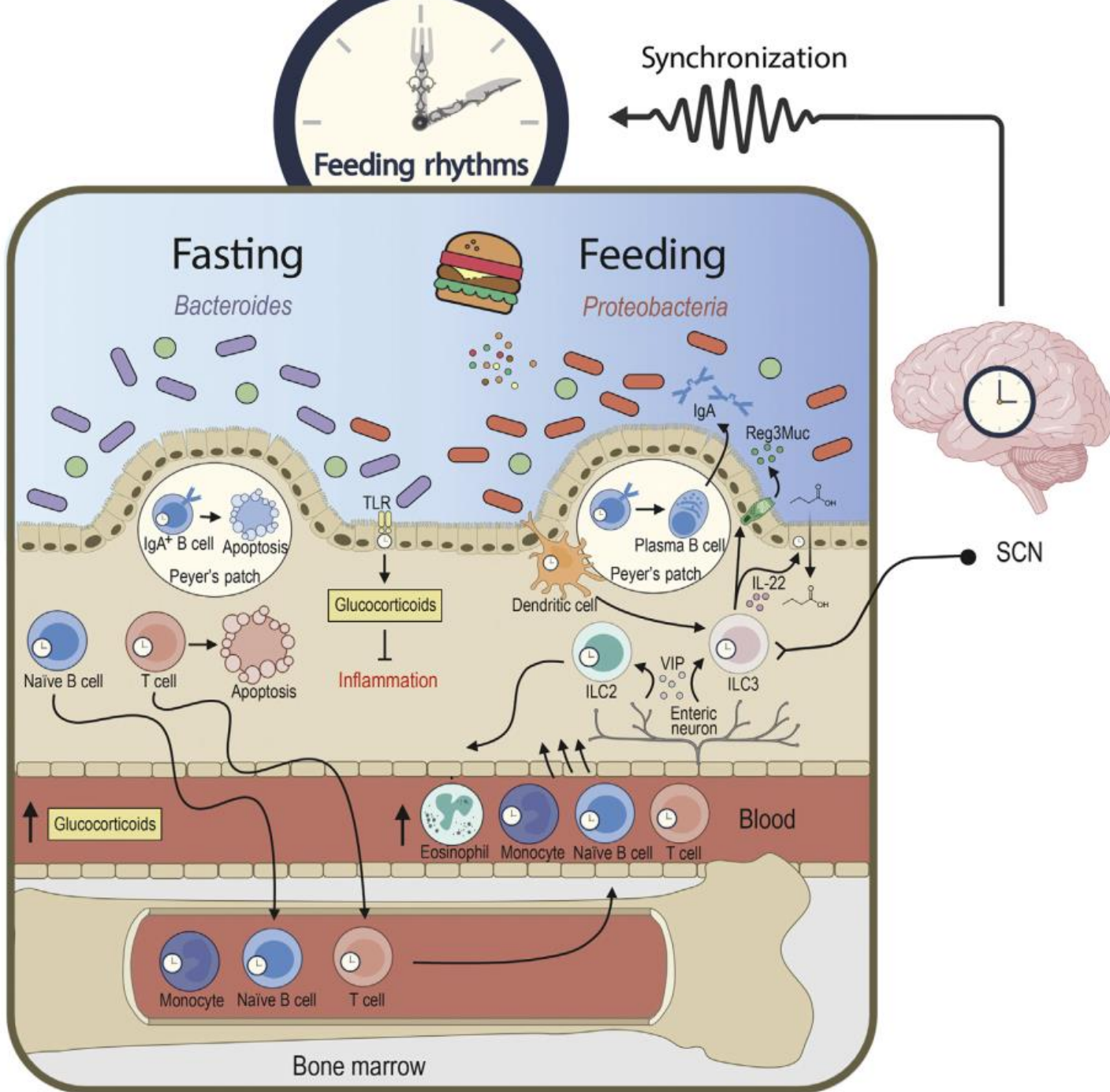
### Liver

↓ Fatty liver

↓ Inflammation

↓ Glucose production

↓ Insulin resistance



# Effects of Intermittent Fasting on Health, Aging, and Disease

Rafael de Cabo, Ph.D., and Mark P. Mattson, Ph.D.

N ENGL J MED 381;26 NEJM.ORG DECEMBER 26, 2019

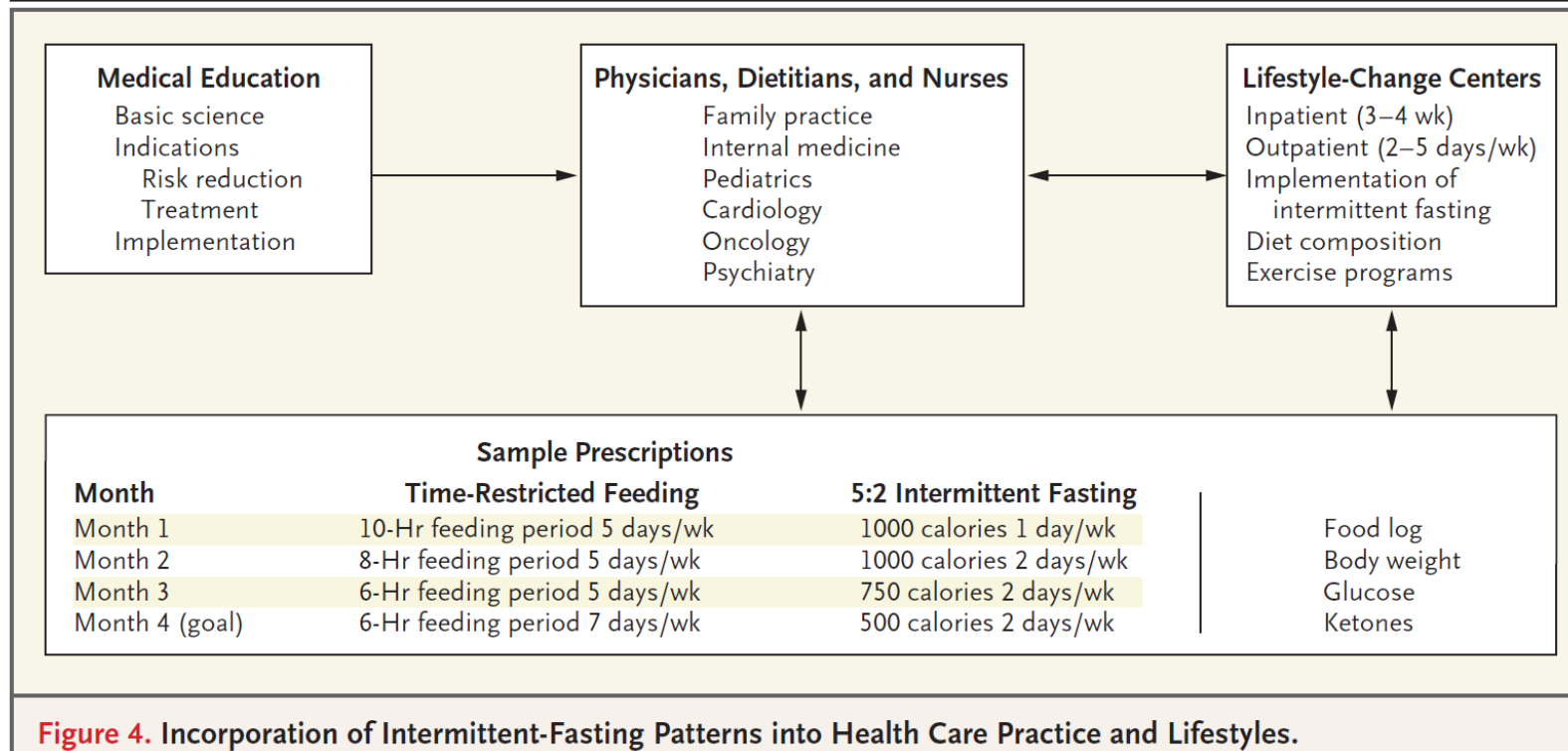
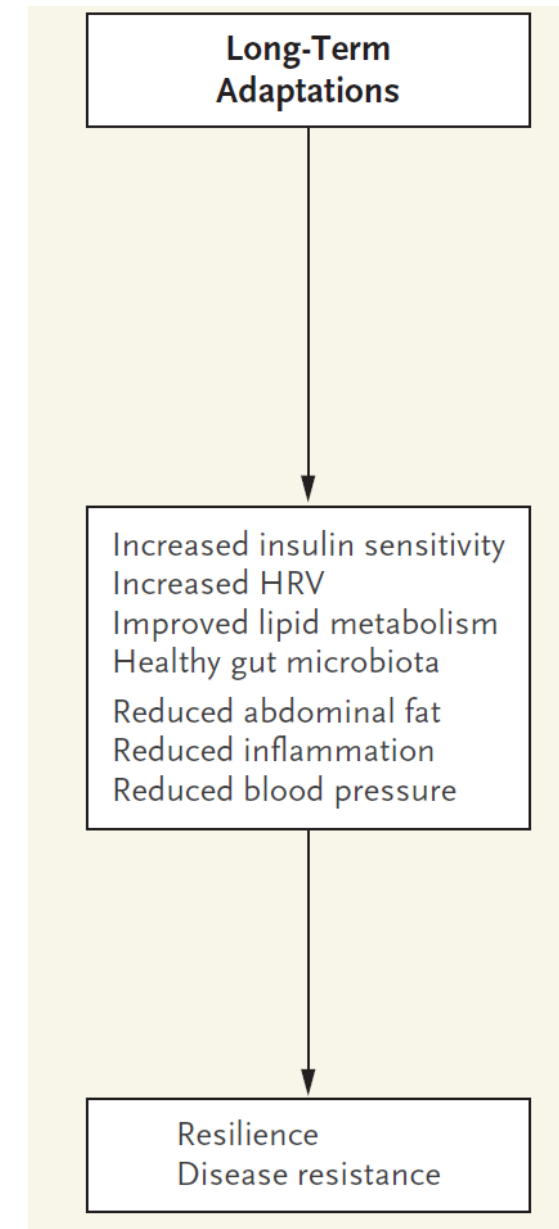


Figure 4. Incorporation of Intermittent-Fasting Patterns into Health Care Practice and Lifestyles.



***Emme ole sitä mitä syömmme,  
vaan sitä mitä bakteerit tekevät  
siitä mitä syömmme !***



**TURUN  
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# Cicero: Otium cum dignitate

Kunniallinen joutilaisuus toteutuu, kun tehtävänsä tehnyt ihminen saa ansaitsemansa vapauden työvelvoitteista.

Tätä ansaittua vapaa-aikaa kaikki täysjärkiset kunnan ihmiset tavoittelevat. Silloin ihminen voi omistautua täysipainoisesti viisauden harrastamiselle.



**“Sattuma suosii  
valmistautunutta  
mieltä”**

**Lillen yliopisto  
Ranska  
7. 12. 1854**

Louis Pasteur'in muotokuva  
(1822-1895)

Albert Edelfelt 1885  
(1854-1905)