

Mitä syöt on terveydelle paljon luultua tärkeämpää

Pentti Huovinen, emeritusprofessori ja -dekaani

Lääketieteellinen tiedekunta

Turun yliopisto



TURUN
YLIOPISTO

Pentti Huovinen

Professori (emeritus), klinisen mikrobiologian erikoislääkäri, tietokirjailija, tiedetoimittaja

2010-2023: Bakteriopin professori, TY; 2019-2023, ylilääkäri TYKS Laboratoriot

2014-2019: Dekaan, lääketieteellinen tiedekunta, Turun yliopisto

1990-2014: Ylilääkäri, tutkimusprofessori, osaston johtaja, päätoimittaja, KTL ja THL

2019-: Hallituksen jäsen, 2023- puheenjohtaja, Sakari Alhopuron säätiö

1986-1987: Research Fellow in Medicine, Harvard Medical School and Massachusetts General Hospital, Boston, USA,

2003: Executive Development Program, Wharton School, University of Pennsylvania

2009: Award of Excellence, European Society for Clinical Microbiology and Infectious Diseases;

2008: Tiedonjulkistamisen valtionpalkinto; 2012: Tietokirjailijoiden Antero Warelus –palkinto;

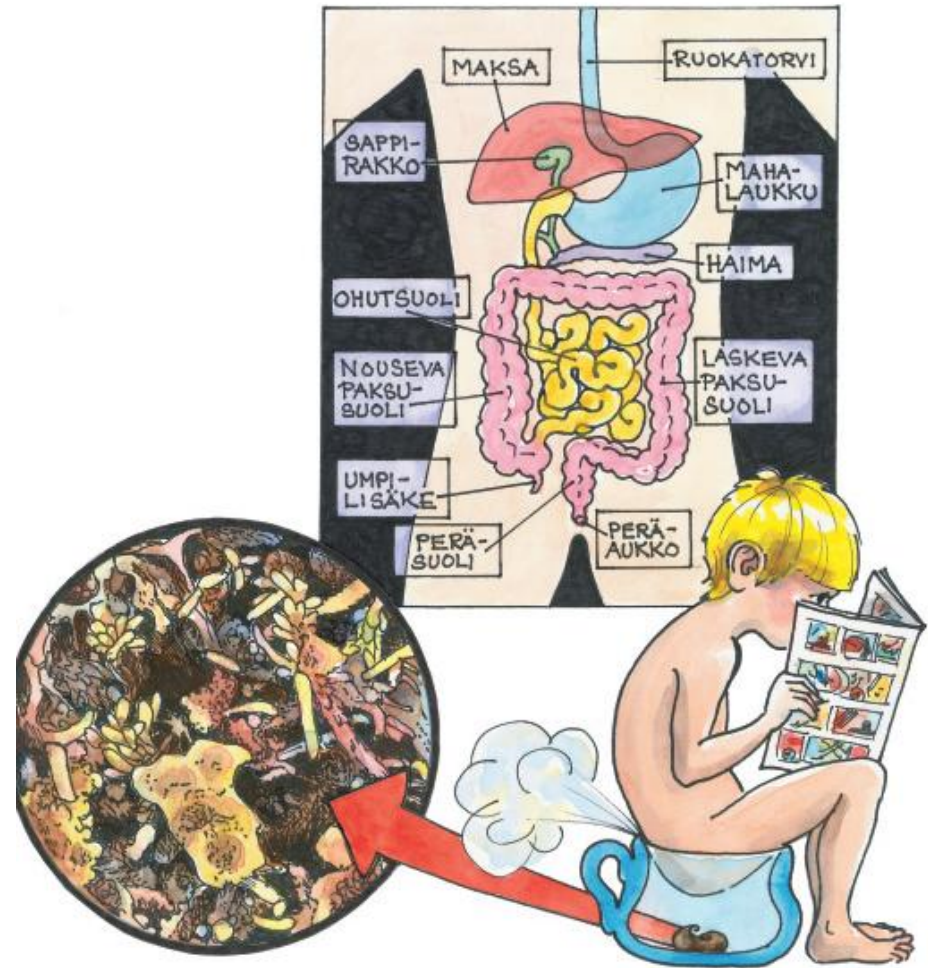
2021: A.I. Virtanen -palkinto

Sidonnaisuudet:

WSOY, Suomen Lääkärilehti ja Kustannus Oy Duodecim (*tekijänpalkkiot*)

Biocodex, Kabi Fresenius, Biogen, Pfizer (*asiantuntija- ja luentopalkkiot*)

Referator Oy (*toimitusjohtaja*), Onnettomuustutkintakeskus (*asiantuntija*)



Kuvat: Huovinen P, Matilainen J
Heippa – täällä bakteeri,
WSOY 2007



**TURUN
YLIOPISTO**

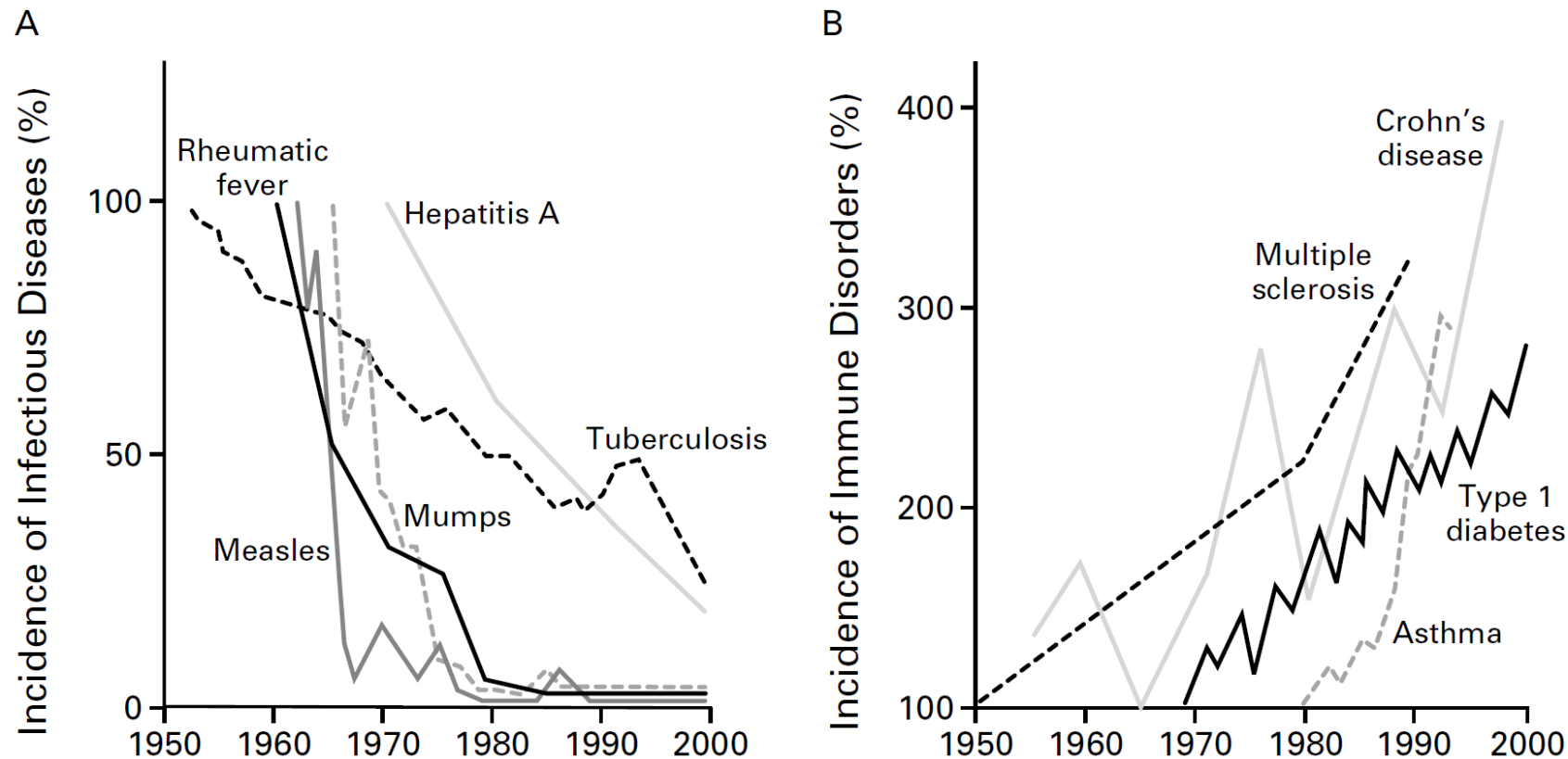


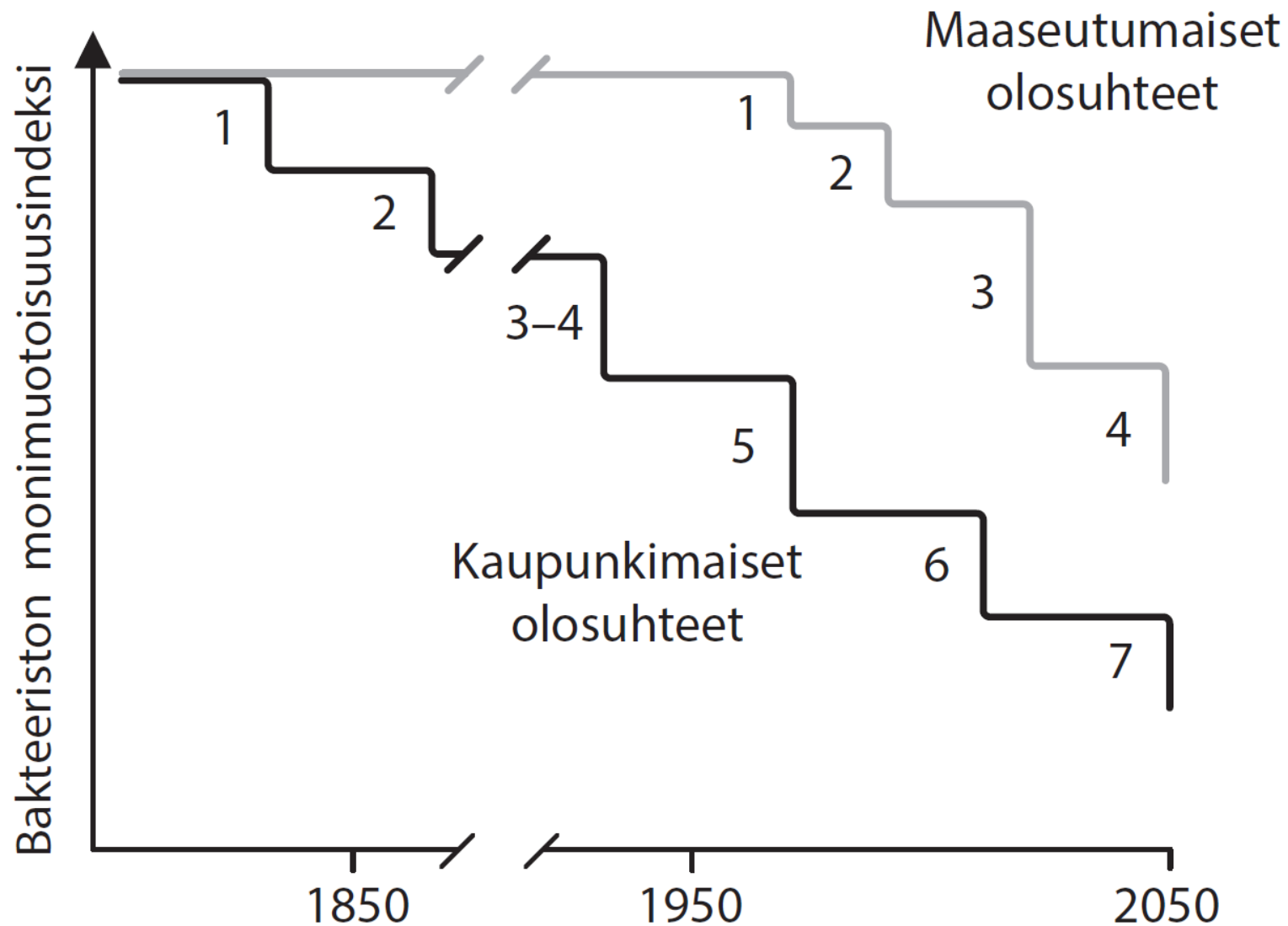
Figure 1. Inverse Relation between the Incidence of Prototypical Infectious Diseases (Panel A) and the Incidence of Immune Disorders (Panel B) from 1950 to 2000.

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.¹² In Panel B, data on immune disorders are derived from Swarbrick et al.,¹⁰ Dubois et al.,¹³ Tuomilehto et al.,¹⁴ and Pugliatti et al.¹⁵



MAALLA

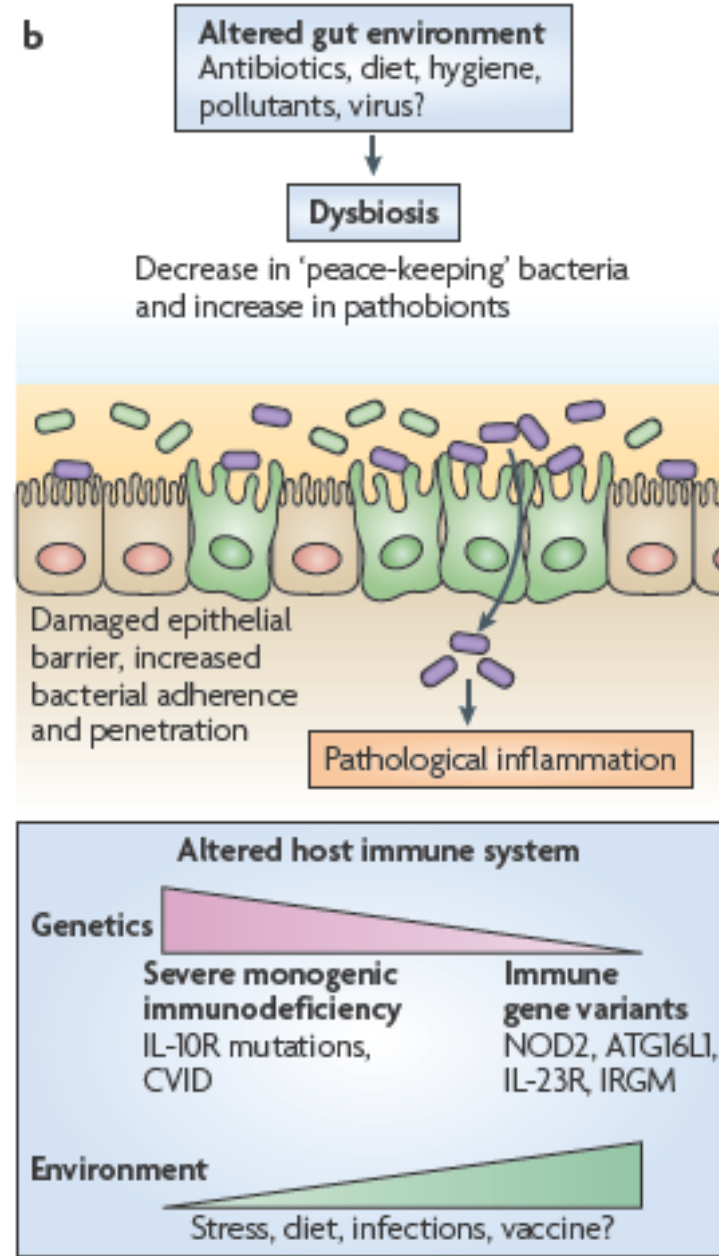
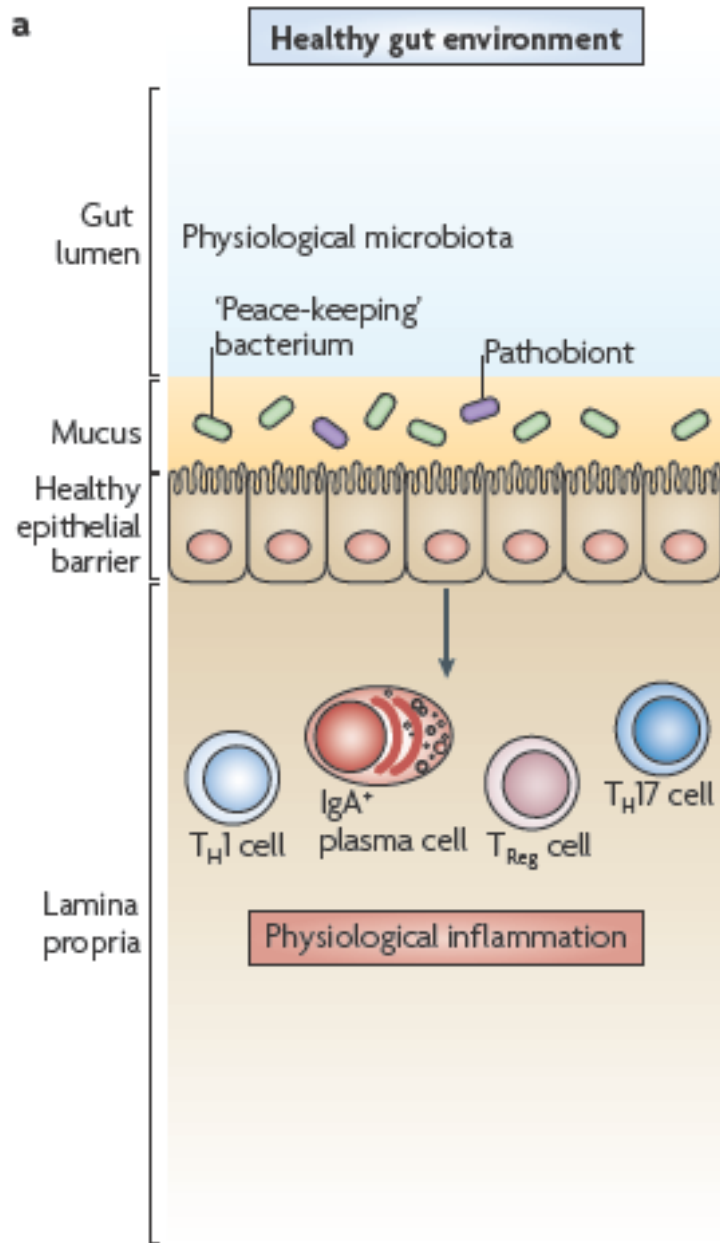




Pentti Huovinen: Parantavat bakteerit, WSOY 2021

Kolme olennaista kysymystä

1. Kuinka ruokkia terveyttä edistäviä mikrobeja?
2. Kuinka estää elimistön tulehdusreaktio eli dysbioosi
3. Mistä ja miten saada terveyttä edistäviä bakteereita?



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

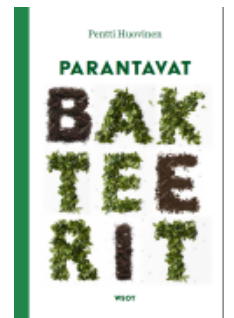
Some forms of arthritis, including rheumatoid arthritis and psoriatic arthritis

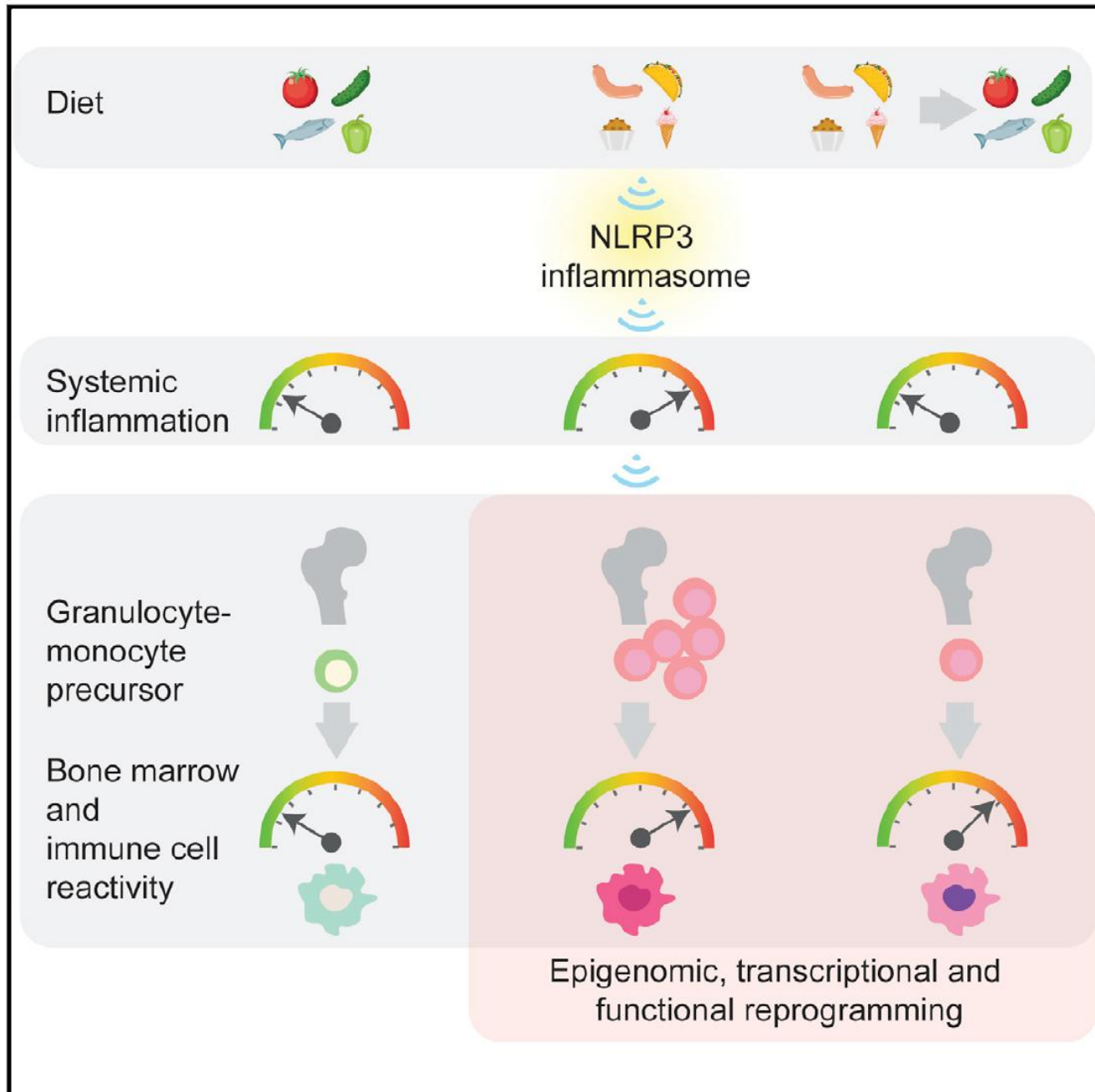
IMMUNE SYSTEM

Autoimmune disorders such as lupus



Ruokakolmio



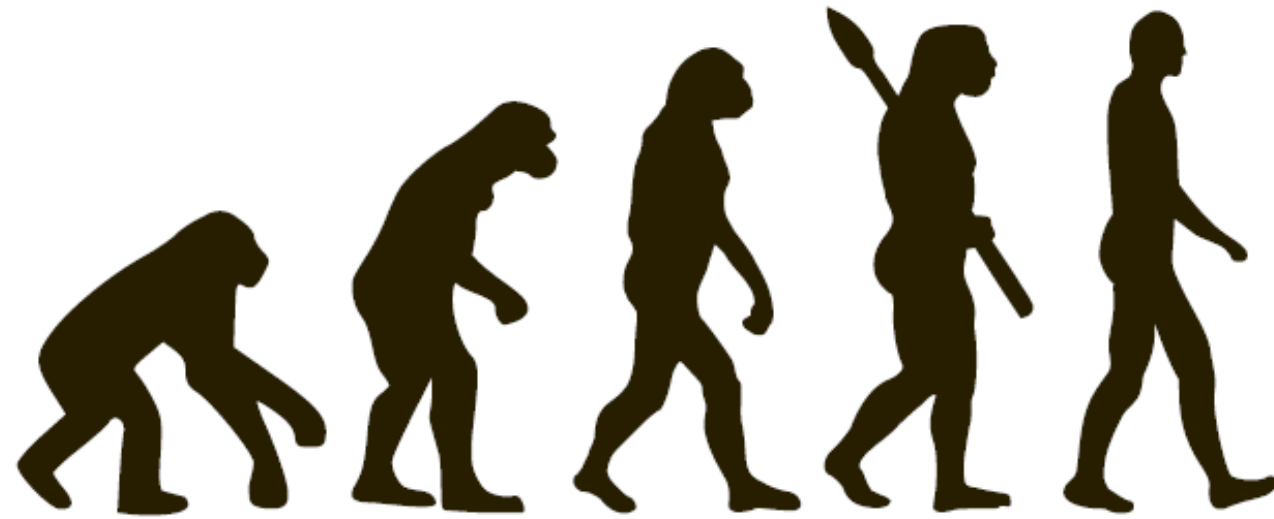


Christ et al., 2018, Cell 172, 162–175
January 11, 2018 © 2017 Elsevier Inc.
<https://doi.org/10.1016/j.cell.2017.12.013>

Länsimainen dieetti aiheutti hiirillä samanlaisen tulehdusreaktion kuin mikrobit

Väestötutkimusten mukaan länsimainen dieetti on tärkeä syy tulehduksellisiin elintasosairauksiin, kuten tyypin kaksi diabetekseen, lihavuuteen sekä sydän- ja verisuonitauteihin

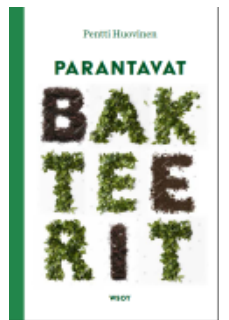
Vähärasvainen ja vähäenerginen dieetti ei aiheuta tulehdusreaktiota vaan jopa sammuttaa sitä



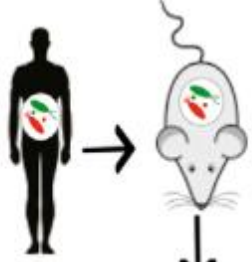
↑
**Kuiturikas
ruokavalio**

↑
**~150 g
kuitua/päivä**

↑
**~20 g
kuitua/päivä**



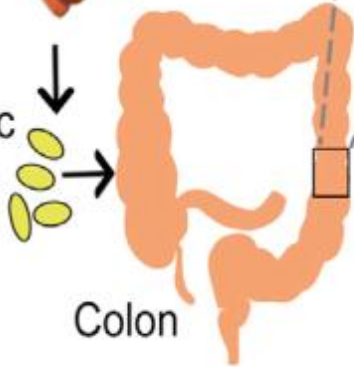
Gnotobiotic mice with characterized human gut microbiota



Dietary fiber deprivation

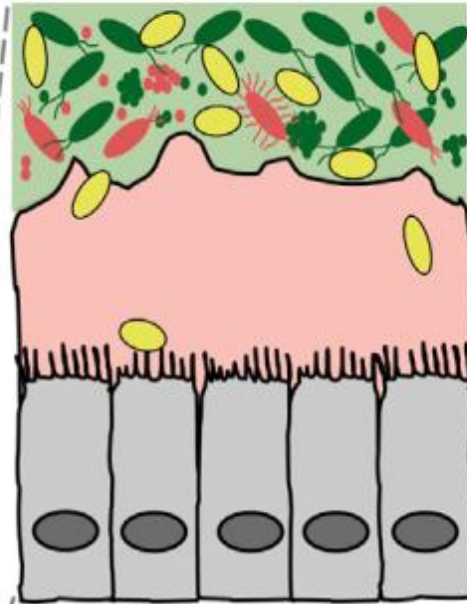


Infection with enteric pathogen



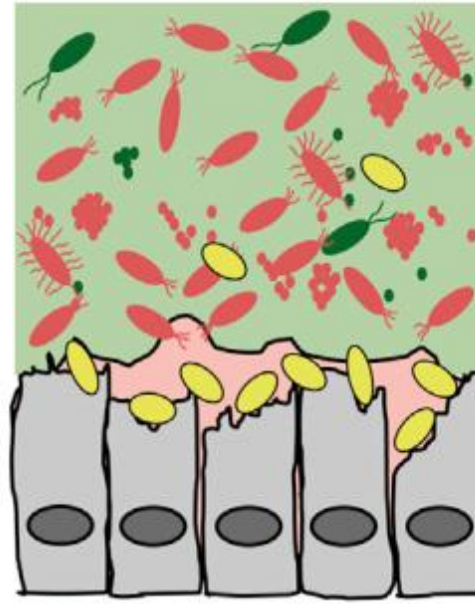
Colon

Fiber-rich diet

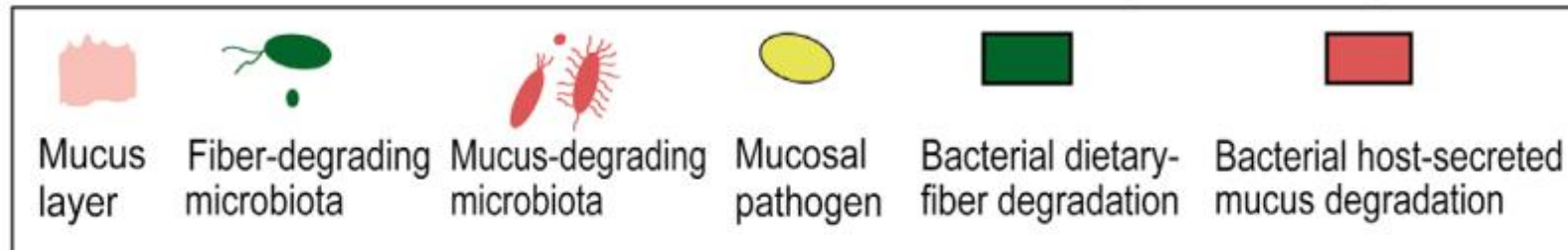


Mature mucus layer:
intact barrier function

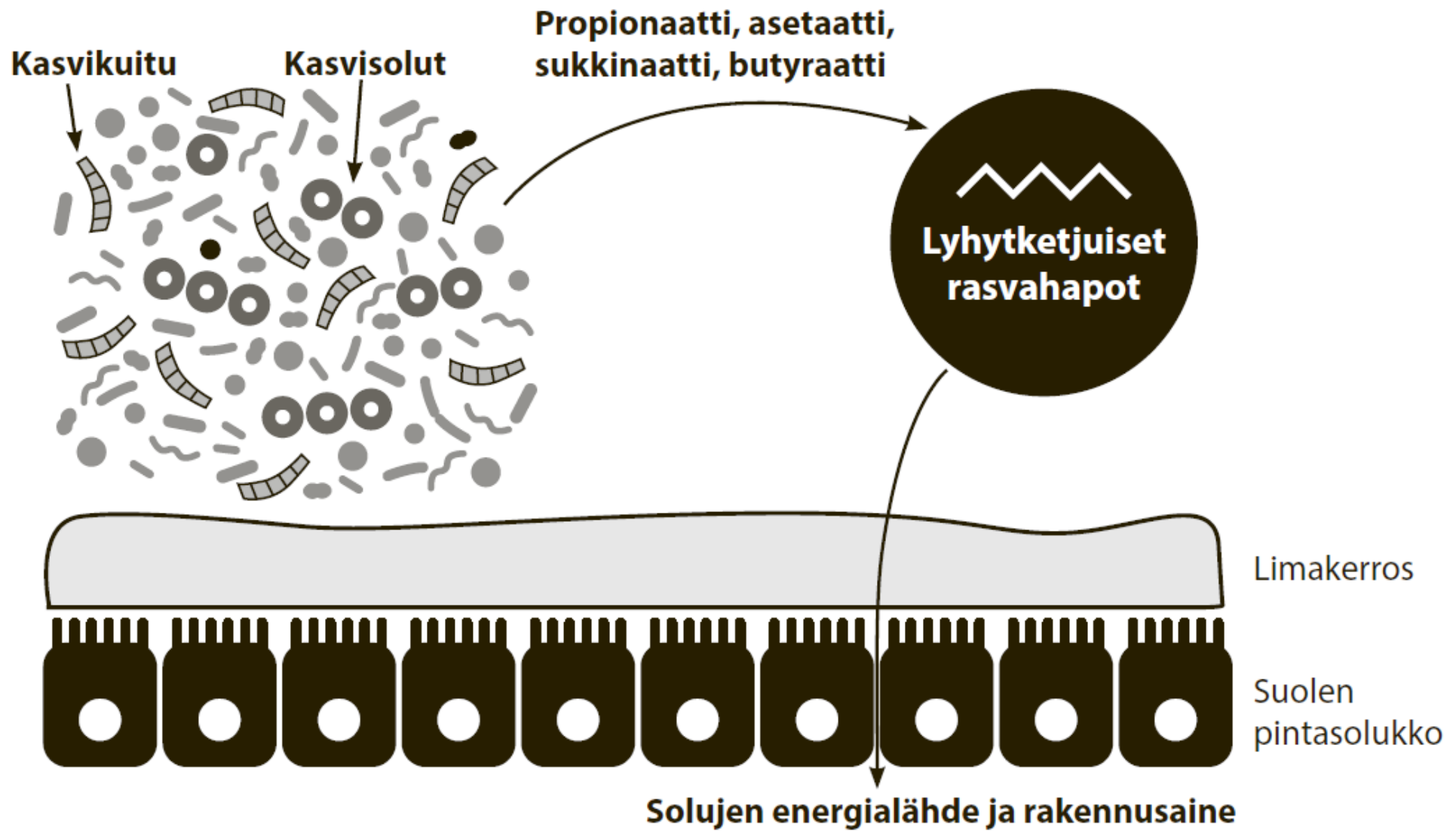
Fiber-free diet



Microbiota eroded mucus
layer: barrier dysfunction



Desai et al., 2016, Cell 167, 1339–1353
November 17, 2016 © 2016 Elsevier Inc.
<http://dx.doi.org/10.1016/j.cell.2016.10.043>



Fat, fibre and cancer risk in African Americans and rural Africans

Stephen J.D. O'Keefe¹, Jia V. Li², Leo Lahti^{3,4}, Junhai Ou¹, Franck Carbonero^{5,†}, Khaled Mohammed¹, Joram M. Posma², James Kinross², Elaine Wahl¹, Elizabeth Ruder⁶, Kishore Vippera¹, Vasudevan Naidoo⁷, Lungile Mtshali⁷, Sebastian Tims³, Philippe G.B. Puylaert³, James DeLany⁸, Alyssa Krasinskas⁹, Ann C. Benefiel⁵, Hatem O. Kaseb¹, Keith Newton⁷, Jeremy K. Nicholson², Willem M. de Vos^{3,4,10}, H. Rex Gaskins⁵ & Erwin G. Zoetendal³

Rates of colon cancer are much higher in **African Americans (65:100,000)** than in rural **South Africans (<5:100,000)**.

We performed 2-week food exchanges in subjects from the same populations. In comparison with their usual diets, the food changes resulted in **remarkable changes** in mucosal biomarkers of cancer risk and in aspects of the **microbiota and metabolome known to affect cancer risk**.

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

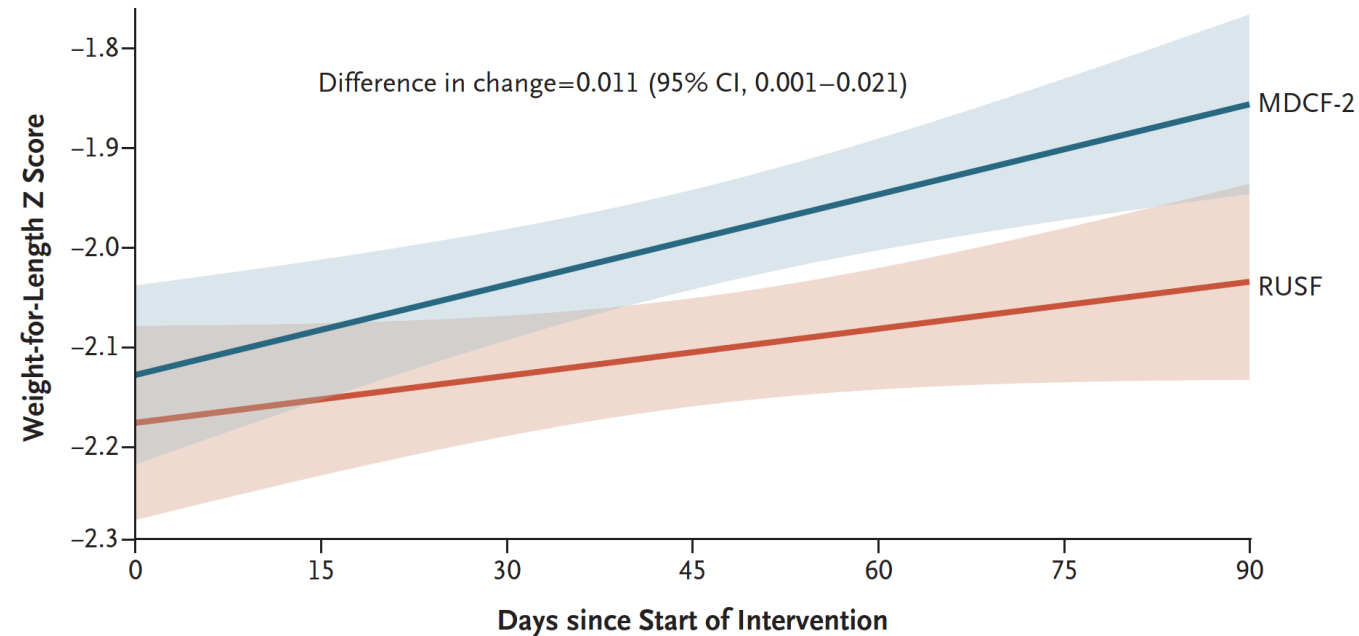
CONCLUSION: These findings demonstrate the translatability of results obtained from pre-clinical gnotobiotic animal models to humans, directly support the hypothesis that healthy microbiota development is causally linked to healthy growth, illustrate an approach for treating childhood undernutrition, 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

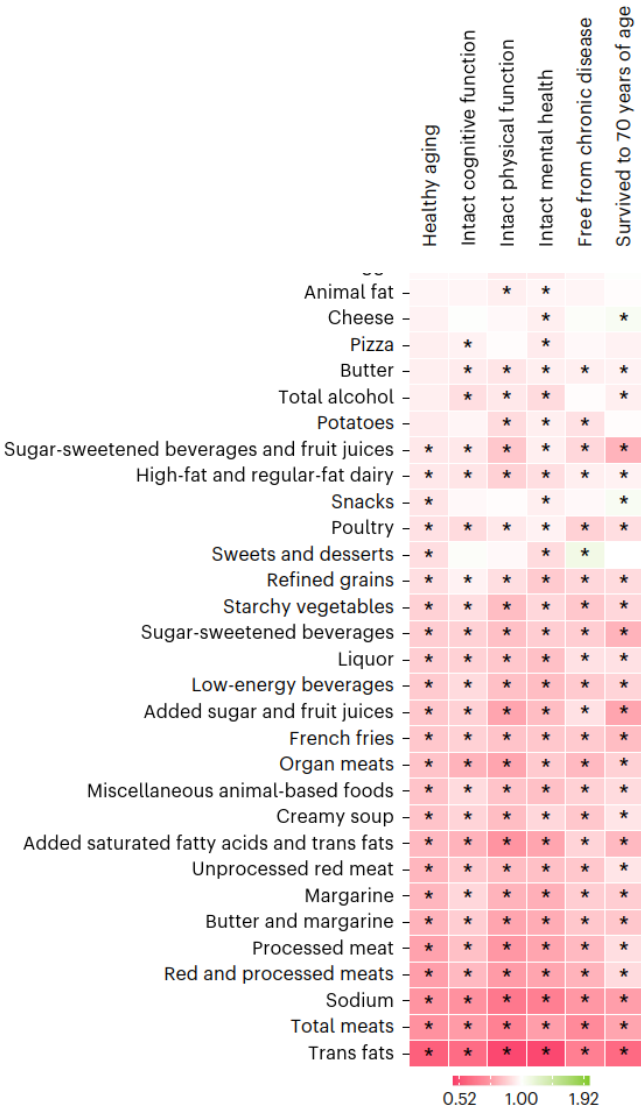
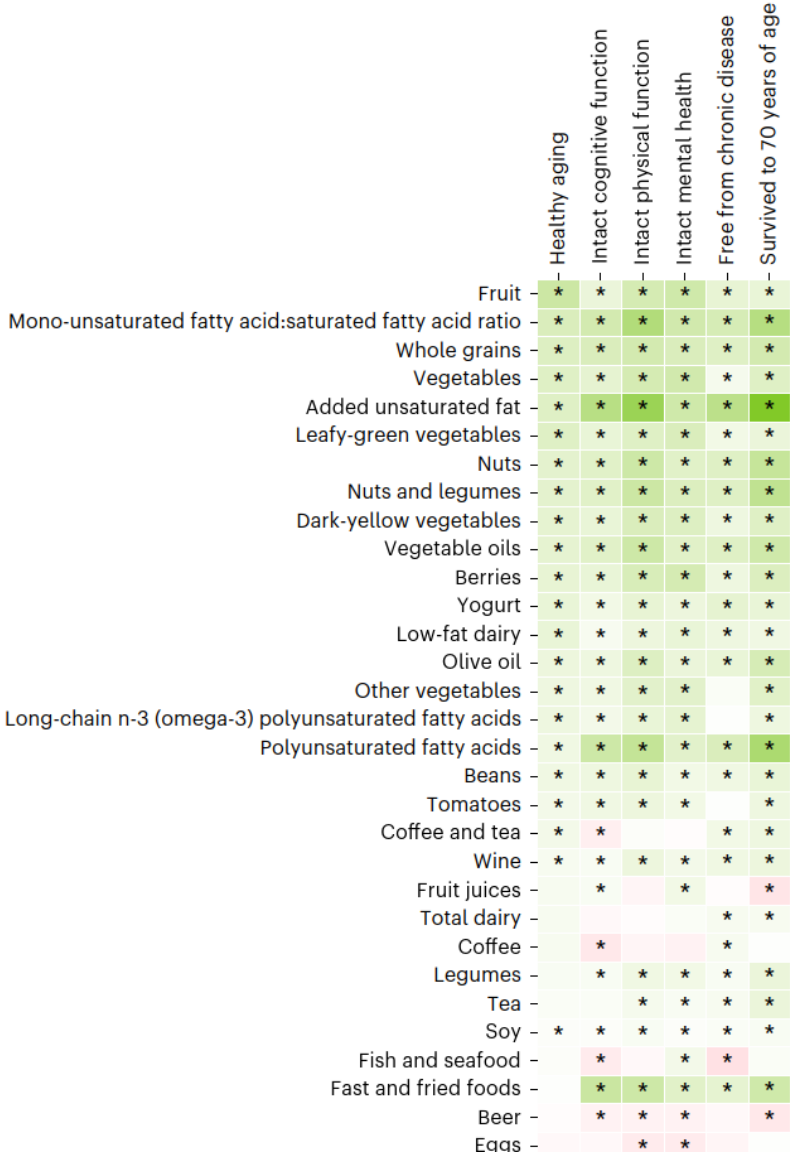
Robert Y. Chen, B.S., Ishita Mostafa, B.D.S., M.P.H., Matthew C. Hibberd, Ph.D.,
Subhasish Das, M.B., B.S., M.P.H., Mustafa Mahfuz, M.B., B.S., M.P.H.,
Nurun N. Naila, M.B., B.S., M.P.H., M. Munirul Islam, M.B., B.S., Ph.D.,
Sayeeda Huq, M.B., B.S., M.P.H., M. Ashraful Alam, M.P.H.,
Mahabub U. Zaman, 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



Optimal dietary patterns for healthy aging



Healthy aging

Intact cognitive function

Intact physical function

Intact mental health

Free from chronic disease

Survived to 70 years of age

	Fruit	*	*	*	*	*	*
	Mono-unsaturated fatty acid:saturated fatty acid ratio	*	*	*	*	*	*
	Whole grains	*	*	*	*	*	*
	Vegetables	*	*	*	*	*	*
Healthy aging	Added unsaturated fat	*	*	*	*	*	*
Intact cognitive function	Leafy-green vegetables	*	*	*	*	*	*
Intact physical function	Nuts	*	*	*	*	*	*
Intact mental health	Nuts and legumes	*	*	*	*	*	*
Free from chronic disease	Dark-yellow vegetables	*	*	*	*	*	*
Survived to 70 years of age	Vegetable oils	*	*	*	*	*	*
	Berries	*	*	*	*	*	*
	Yogurt	*	*	*	*	*	*
	Low-fat dairy	*	*	*	*	*	*
	Olive oil	*	*	*	*	*	*
	Other vegetables	*	*	*	*		*
	Long-chain n-3 (omega-3) polyunsaturated fatty acids	*	*	*	*		*
	Polyunsaturated fatty acids	*	*	*	*	*	*
	Beans	*	*	*	*	*	*
	Tomatoes	*	*	*	*		*
	Coffee and tea	*	*			*	*

Healthy aging	Long-chain n-3 (omega-3) polyunsaturated fatty acids	-	*	*	*	*		*
	Polyunsaturated fatty acids	-	*	*	*	*	*	*
	Beans	-	*	*	*	*	*	*
	Tomatoes	-	*	*	*	*		*
	Coffee and tea	-	*	*			*	*
	Wine	-	*	*	*	*	*	*
	Fruit juices	-		*		*		*
	Total dairy	-					*	*
	Coffee	-		*			*	
	Legumes	-		*	*	*	*	*
Intact cognitive function	Tea	-			*	*	*	*
	Soy	-	*	*	*	*	*	*
Intact physical function	Fish and seafood	-		*		*	*	
	Fast and fried foods	-		*	*	*	*	*
Intact mental health	Beer	-		*	*	*		*
	Eggs	-			*	*		
Free from chronic disease								
Survived to 70 years of age								

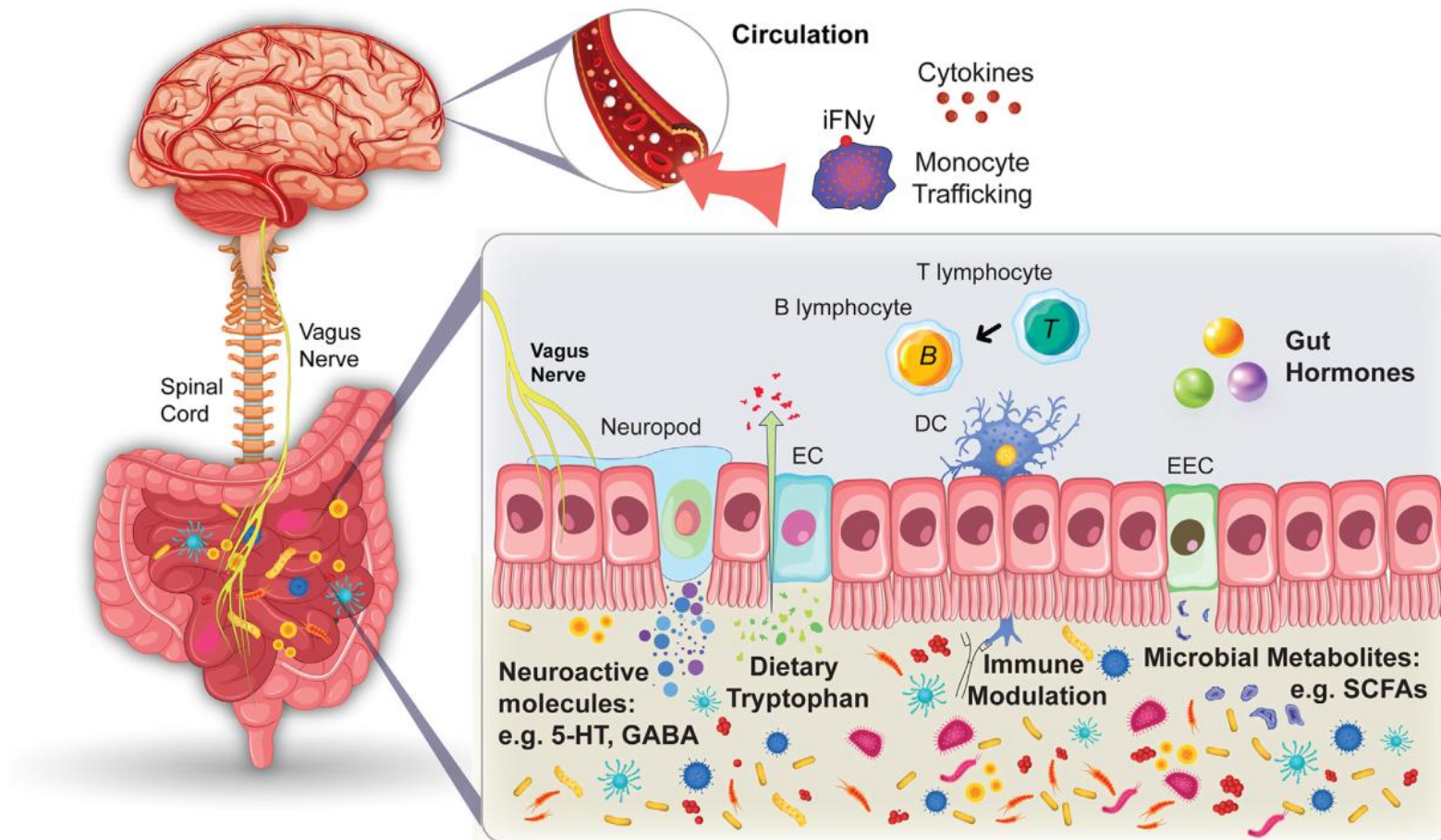
	Animal fat	-			*	*		
	Cheese	-				*		*
	Pizza	-		*		*		
	Butter	-		*	*	*	*	*
	Total alcohol	-		*	*	*		*
	Potatoes	-			*	*	*	
	Sugar-sweetened beverages and fruit juices	-	*	*	*	*	*	*
	High-fat and regular-fat dairy	-	*	*	*	*	*	*
	Snacks	-	*			*		*
	Poultry	-	*	*	*	*	*	*
Healthy aging	Sweets and desserts	-	*			*	*	
Intact cognitive function	Refined grains	-	*	*	*	*	*	*
Intact physical function	Starchy vegetables	-	*	*	*	*	*	*
Intact mental health	Sugar-sweetened beverages	-	*	*	*	*	*	*
Free from chronic disease	Liquor	-	*	*	*	*	*	*
Survived to 70 years of age	Low-energy beverages	-	*	*	*	*	*	*
	Added sugar and fruit juices	-	*	*	*	*	*	*
	French fries	-	*	*	*	*	*	*

Healthy aging	Sugar-sweetened beverages					*
	Liquor					*
Intact cognitive function	Low-energy beverages					*
Intact physical function	Added sugar and fruit juices					*
Intact mental health	French fries					*
Free from chronic disease	Organ meats					*
Survived to 70 years of age	Miscellaneous animal-based foods					*
	Creamy soup					*
	Added saturated fatty acids and trans fats					*
	Unprocessed red meat					*
	Margarine					*
	Butter and margarine					*
	Processed meat					*
	Red and processed meats					*
	Sodium					*
	Total meats					*
	Trans fats					*

Review

The gut microbiota-immune-brain axis: Therapeutic implications

<https://doi.org/10.1016/j.xcrm.2025.101982>



RESEARCH

Open Access

Brain age mediates gut microbiome dysbiosis-related cognition in older adults



Conclusions

We found that brain age mediated the relationship between cluster-related gut microbiome dysbiosis and cognitive performance. Our results suggest that the relationship between increased gut microbiome dysbiosis and worsened cognitive performance may be partially mediated by brain age. The implications of these findings could pave the way for novel interventions targeting the gut microbiome to mitigate age-related cognitive decline and improve the quality of life in older adults.

The microbiome and human cancer

Gregory D. Sepich-Poore¹, Laurence Zitvogel^{2,3,4,5}, Ravid Straussman⁶, Jeff Hasty^{1,7,8},
Jennifer A. Wargo^{9,10}, Rob Knight^{1,11,12*}

Sepich-Poore *et al.*, *Science* **371**, eabc4552 (2021) 26 March 2021 Corrected 17 July 2023.

tation landscape. Large-scale clinical trials are currently testing the efficacy of microbiota modulation approaches, ranging from dietary modifications to intratumorally injected, engineered bacteria. These bacterial cancer therapies, if safe and effective, could tremendously expand the cancer therapy armamentarium. Altogether, integrating the

Microbiome and cancer

Nyssa Cullin,^{1,4} Camila Azevedo Antunes,^{1,4} Ravid Straussman,² Christoph K. Stein-Thoeringer,^{1,*} and Eran Elinav^{1,3,*}

¹Microbiome and Cancer Division, German Cancer Research Center (DKFZ), Im Neuenheimer Feld 280, 69120 Heidelberg, Germany

²Department of Molecular Cell Biology, Weizmann Institute of Science, 234 Herzl Street, 7610001 Rehovot, Israel

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<https://doi.org/10.1016/j.ccell.2021.08.006>

Cancer Cell 39, October 11, 2021

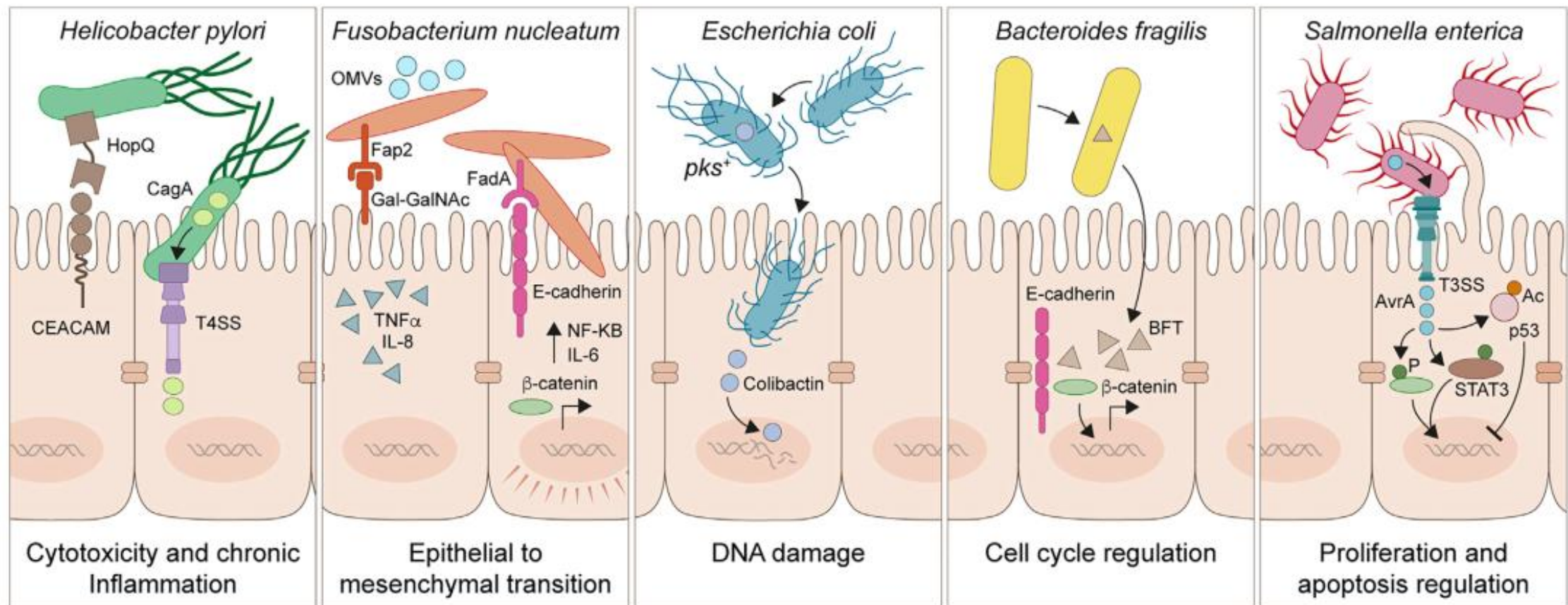
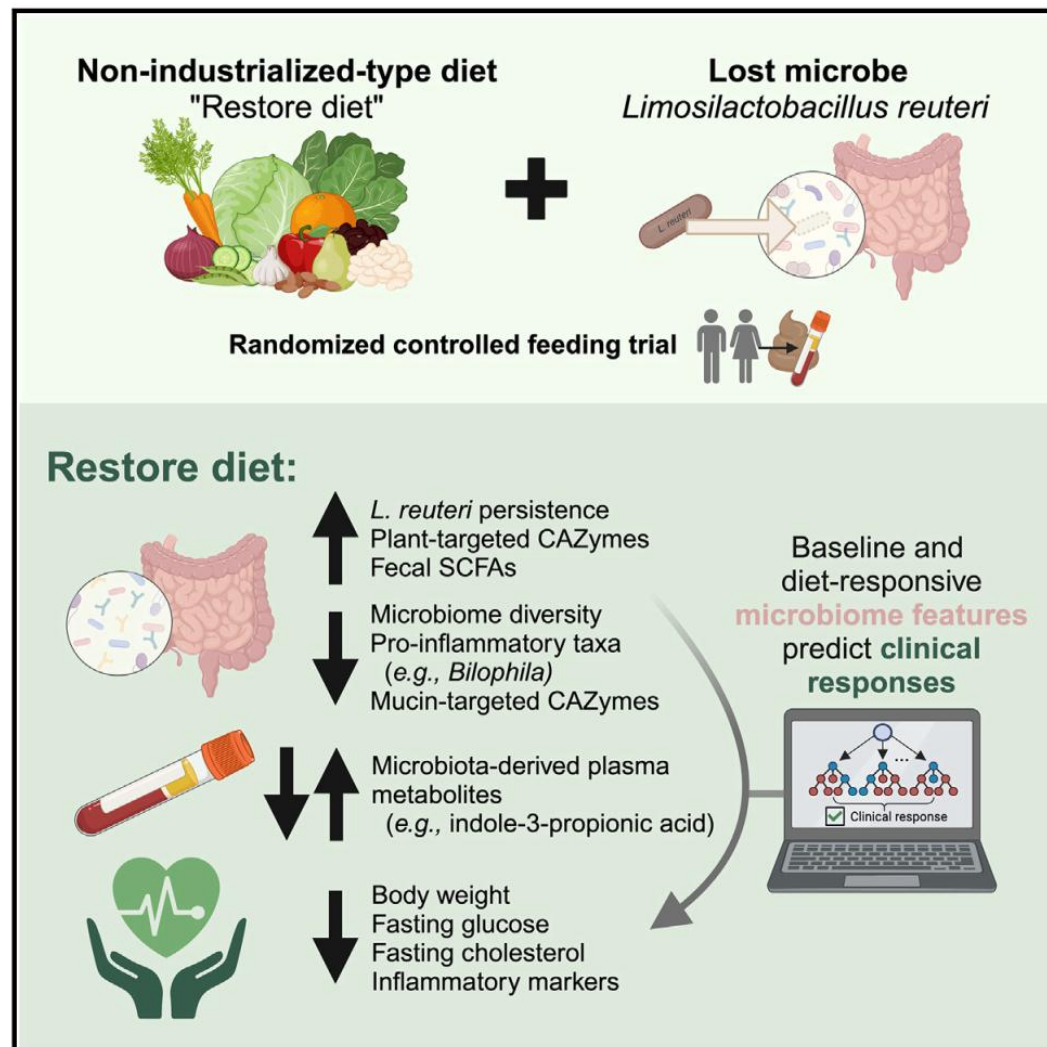


Figure 2. Microbial impacts on neoplastic processes in epithelial cells

Cardiometabolic benefits of a non-industrialized-type diet are linked to gut microbiome modulation

Graphical abstract



Li et al., 2025, Cell 188, 1226–1247

March 6, 2025 © 2025 The Authors. Published by Elsevier Inc.

<https://doi.org/10.1016/j.cell.2024.12.034>

In brief

Is it possible to restore the human gut microbiome in industrialized settings and reintroduce microbial species that have been lost? In healthy adults, Li et al. found that consuming a diet mimicking non-industrialized dietary patterns (restore diet) together with a bacterium rarely found in industrialized human gut microbiomes (*Limosilactobacillus reuteri*) enhanced persistence of the latter. The diet also redressed several microbiome features altered by industrialization, which was linked to considerable cardiometabolic benefits.

Akkermansia muciniphila: paradigm for next-generation beneficial microorganisms

Patrice D. Cani¹✉, Clara Depommier¹, Muriel Derrien², Amandine Everard¹
and Willem M. de Vos^{3,4}

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^T 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

↑ β -oxidation



Blood

↓ Plasma glucose levels

↓ Plasma cholesterol levels

↓ Plasma triglyceride levels



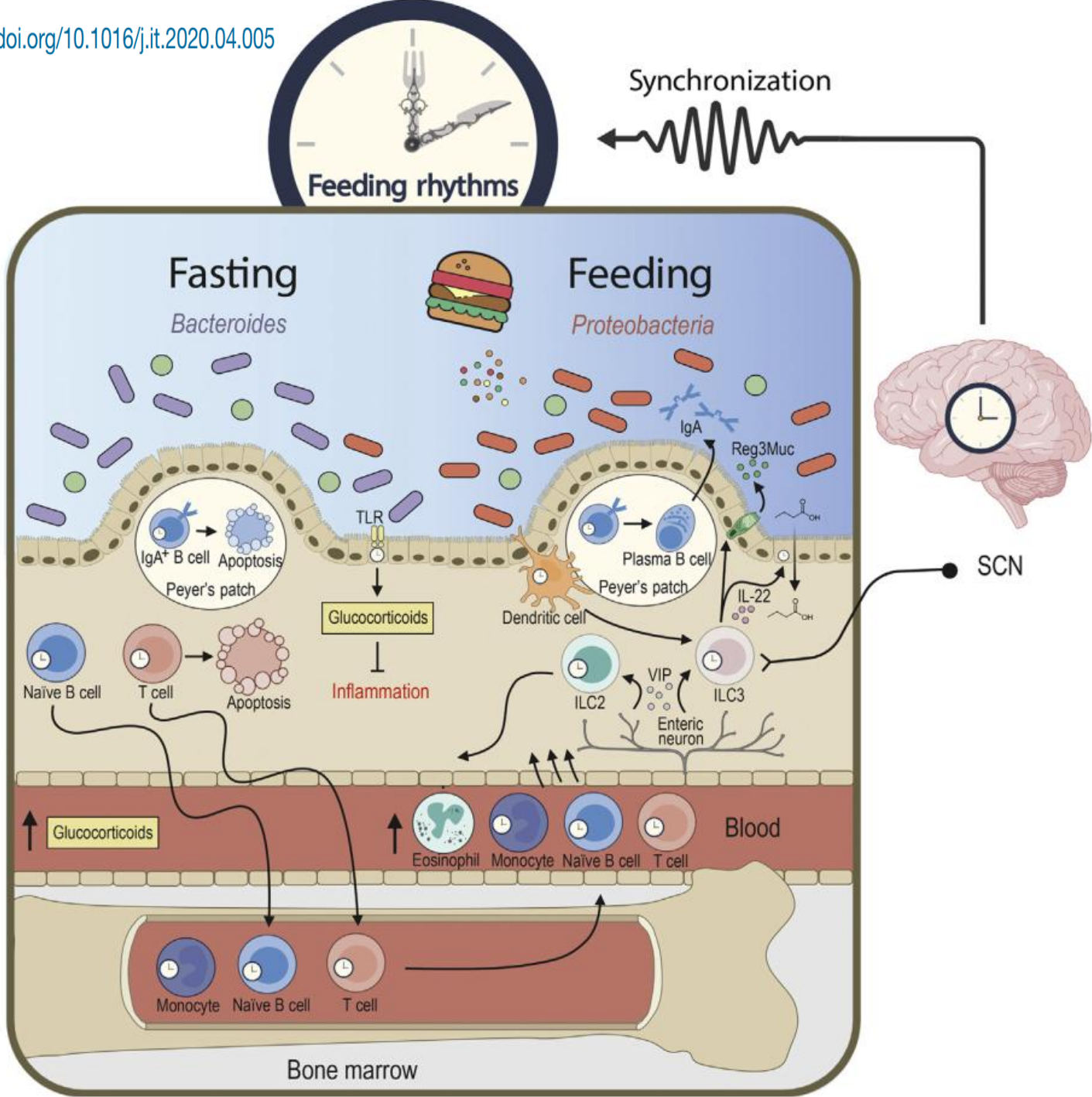
Liver

↓ 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

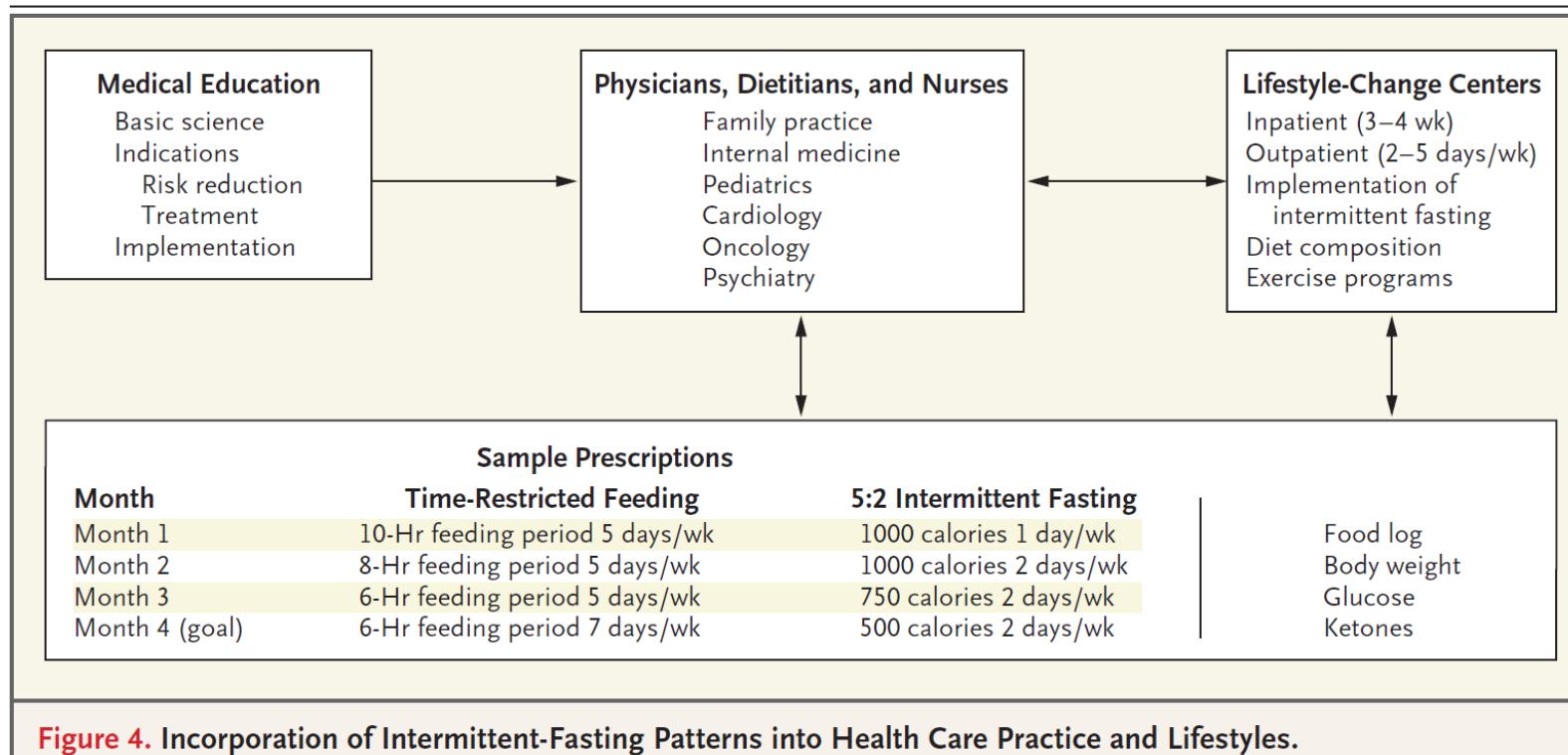
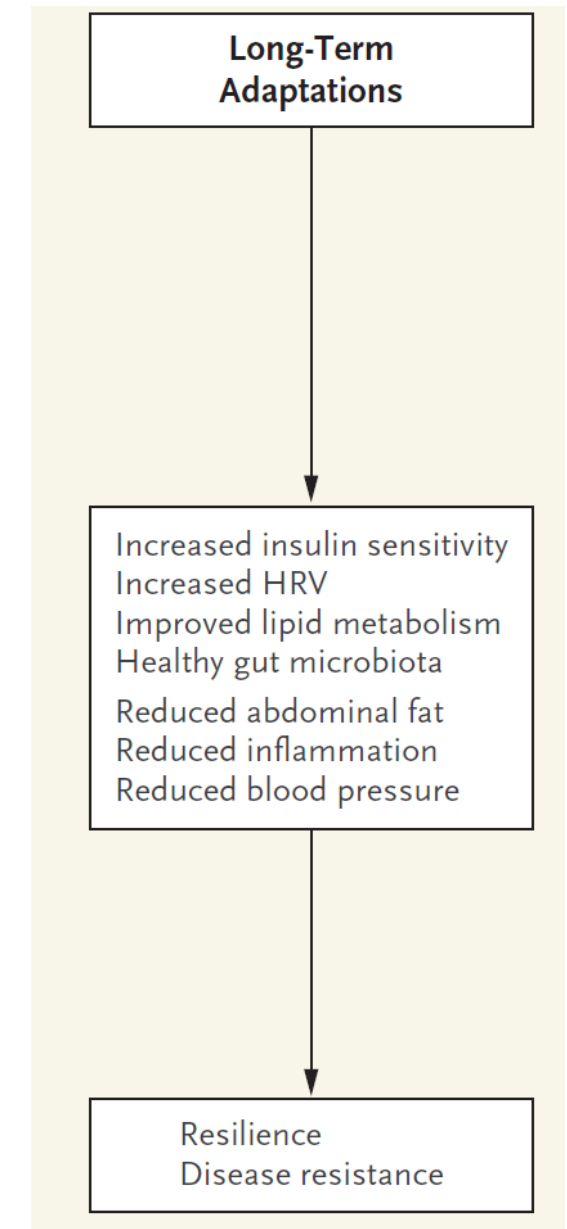


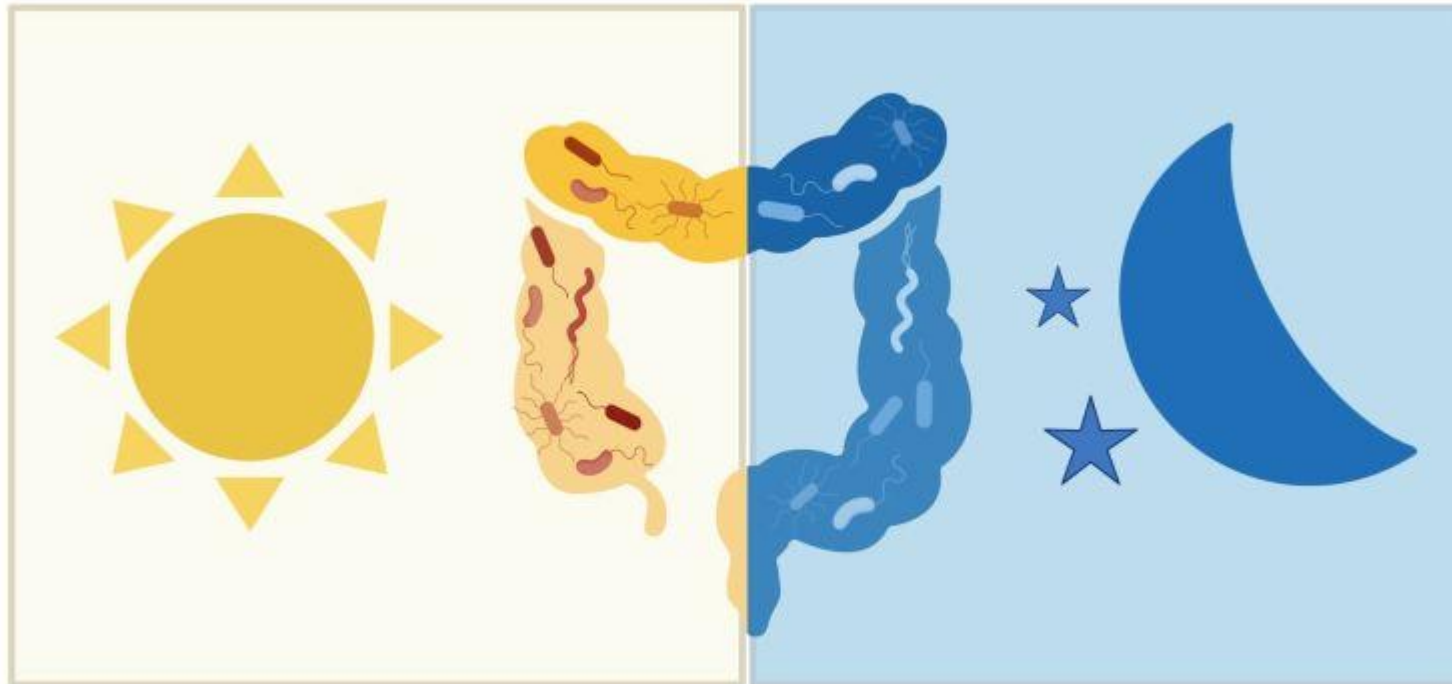
Figure 4. Incorporation of Intermittent-Fasting Patterns into Health Care Practice and Lifestyles.



Can't Sleep? Your Microbiome May Play a Role

The gut microbiome plays a role in sleep regulation; its composition fluctuates throughout the day.

Source: BioRender.com; American Society for Microbiology Nov 11, 2025



Microbes Impact Sleep—And Vice Versa



**“Sattuma suosii
valmistautunutta
mieltä”**

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

Louis Pasteur'in (1822-1895)
muotokuva

D'Orsay, Pariisi

Albert Edelfelt 1885
(1854-1905)



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Kiitos!

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