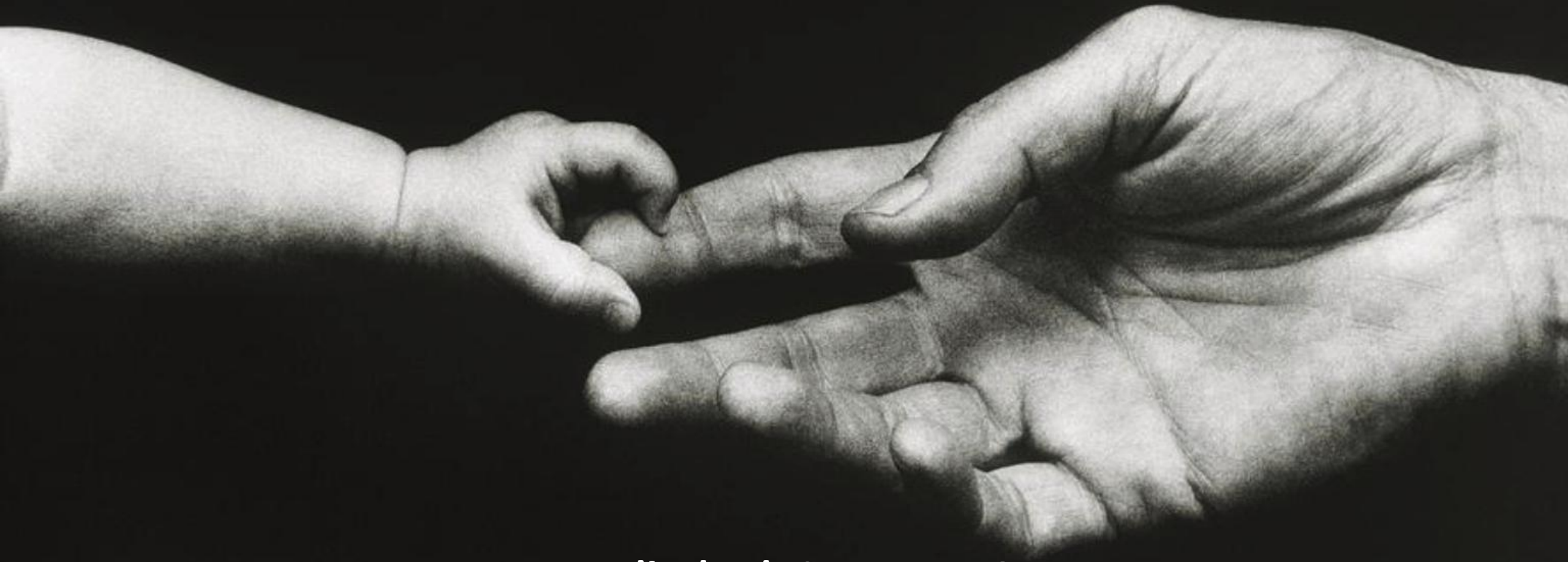


Lifestyle, Epigenetics, and the Microbiome



M. Elizabeth Swenor, DO
MOA Autumn Conference
10-25-25

I have no financial disclosures

Objectives

- 1. Define Whole Person Health**
- 2. Define Epigenetics, Lifespan, Healthspan, Transgenerational Inheritance, and the Human Microbiome**
- 2. Discuss lifestyle modification for optimizing human healthspan, microbiota health, and reducing health risks of stress driven aberrant epigenetic changes**



Whole-person health is an approach that integrates physical, mental, and social well-being by focusing on lifestyle choices like nutrition, exercise, sleep, and stress management, and encompasses the influences of social and environmental factors.



Whole person health emphasizes that true health is more than just the absence of disease and involves creating a lifestyle that promotes resilience, restores health, and prevents illness throughout life

Sarah 62 yo Caucasian Female

CC: morbid obesity, fatigue, weight gain, uncontrolled T2DM, Crohn's disease with diarrhea and bloating



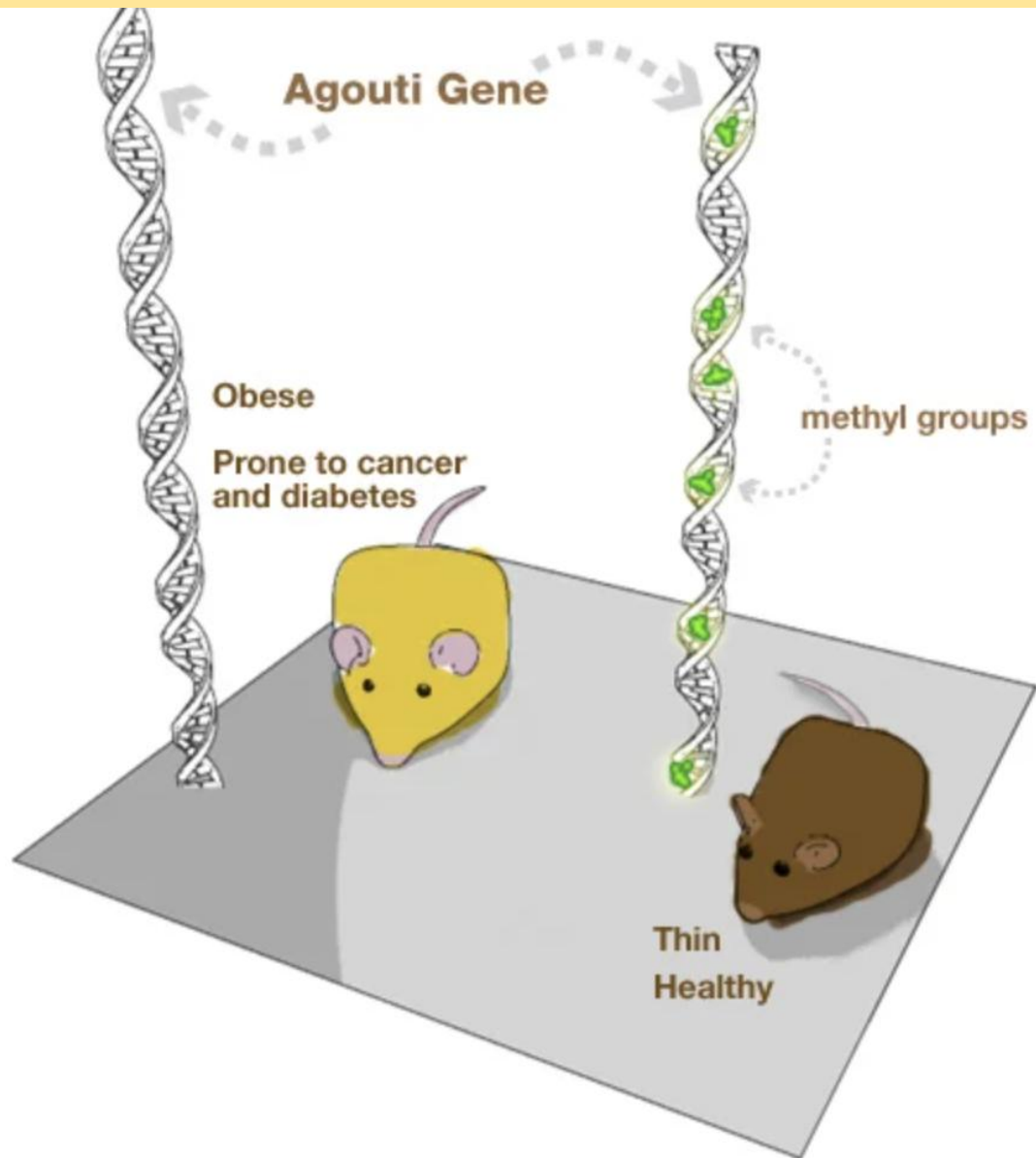
PMHX

- **Age 45 -NSTEMI- 99% stenosis mid-RCA and LAD stenosis**
- **250 pounds. BMI 44.3**
- **Hypertension**
- **Hyperlipidemia**
- **Hashimoto's hypothyroidism**
- **T2DM HbA1C 8.5 non complaint with prescription medications**
- **Crohn's disease**
- **Lupus**
- **Psoriasis**
- **Depression, anxiety, insomnia with daytime hypersomnolence**
- **Low Vitamin B12 and D3, Low magnesium**

Your DNA is NOT Your Destiny (Epigenetics)

Why Your DNA Isn't Your Destiny | Jan. 18, [2010](#)
Randy Jirtle, PhD





These Two Mice are Genetically Identical and the Same Age



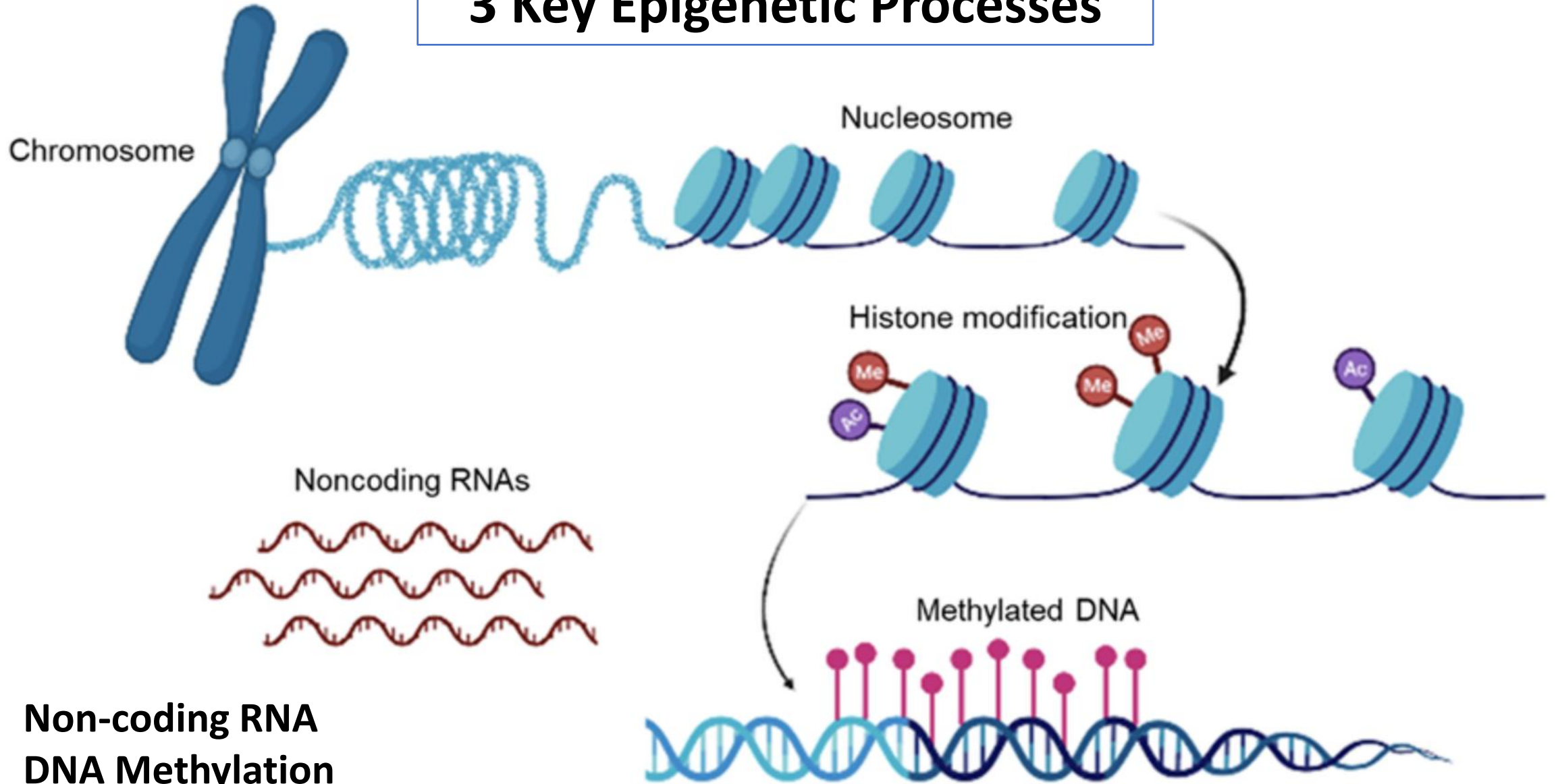
While pregnant, both of their mothers were fed Bisphenol A (BPA) but **DIFFERENT DIETS**:

The mother of this mouse received a **normal mouse diet**

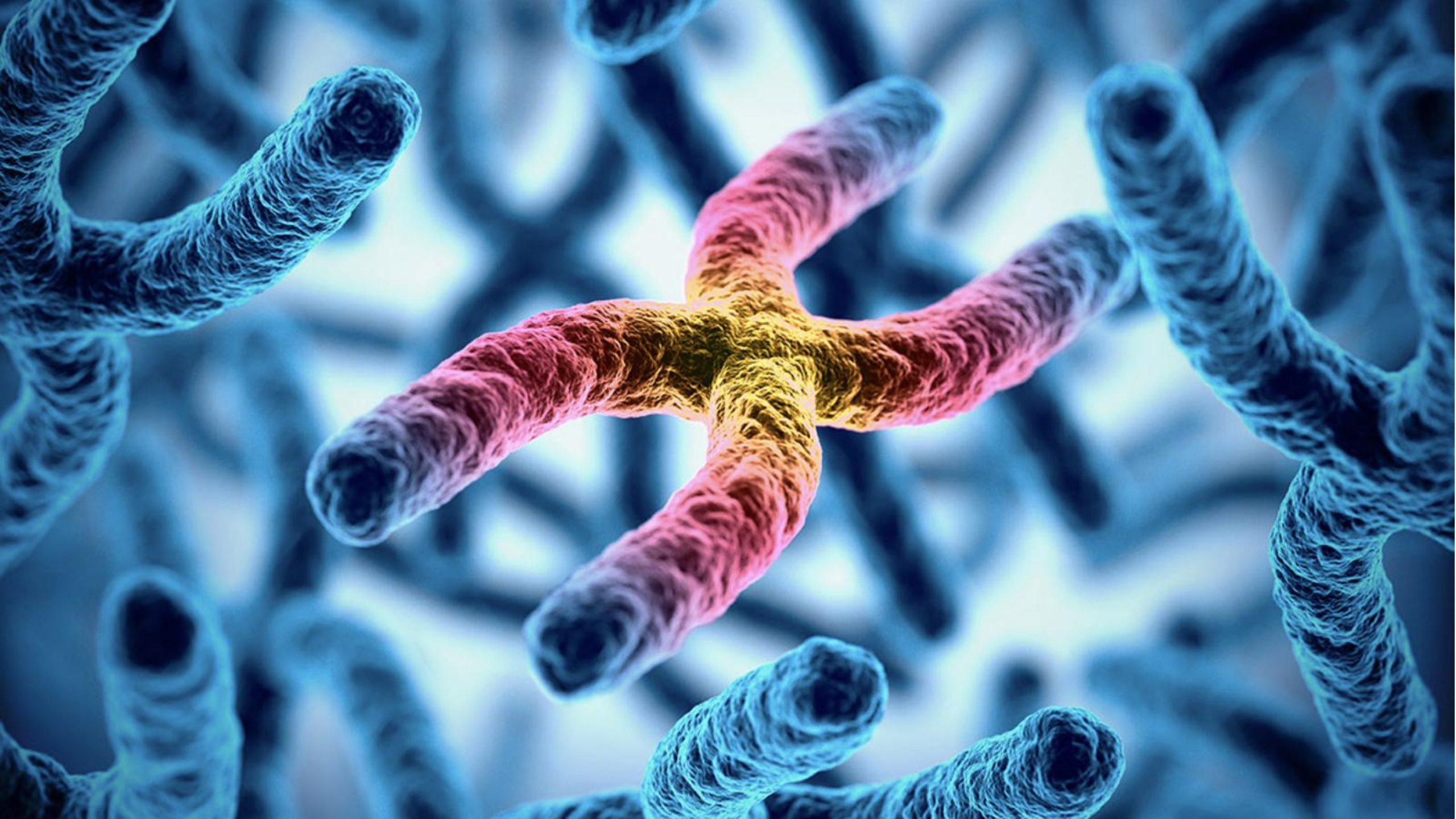
The mother of this mouse received a diet **supplemented** with choline, folic acid, betaine and vitamin B12

Photo courtesy Randy L. Jirtle, PhD

3 Key Epigenetic Processes



1. Non-coding RNA
2. DNA Methylation
3. Histone modification

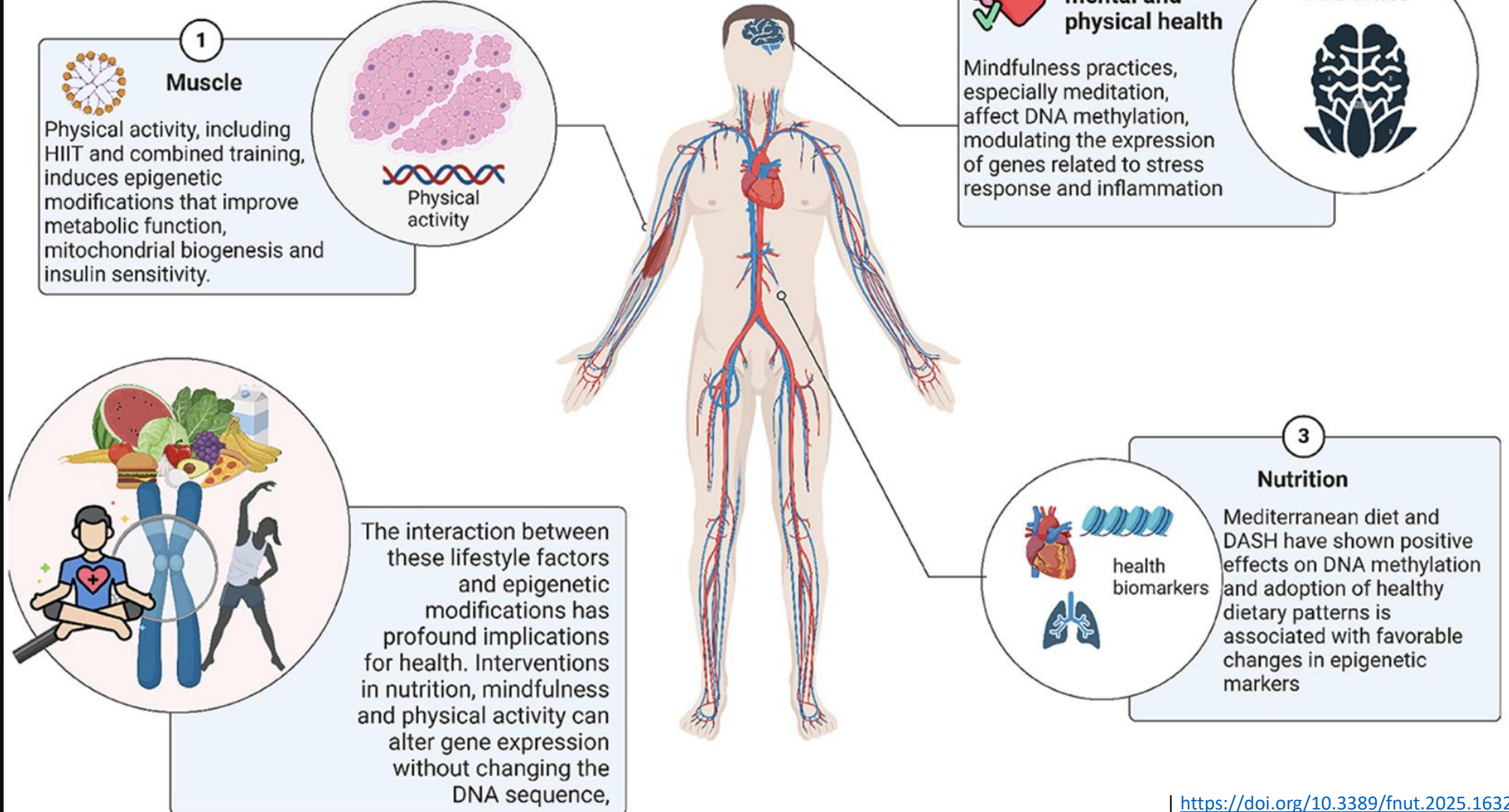


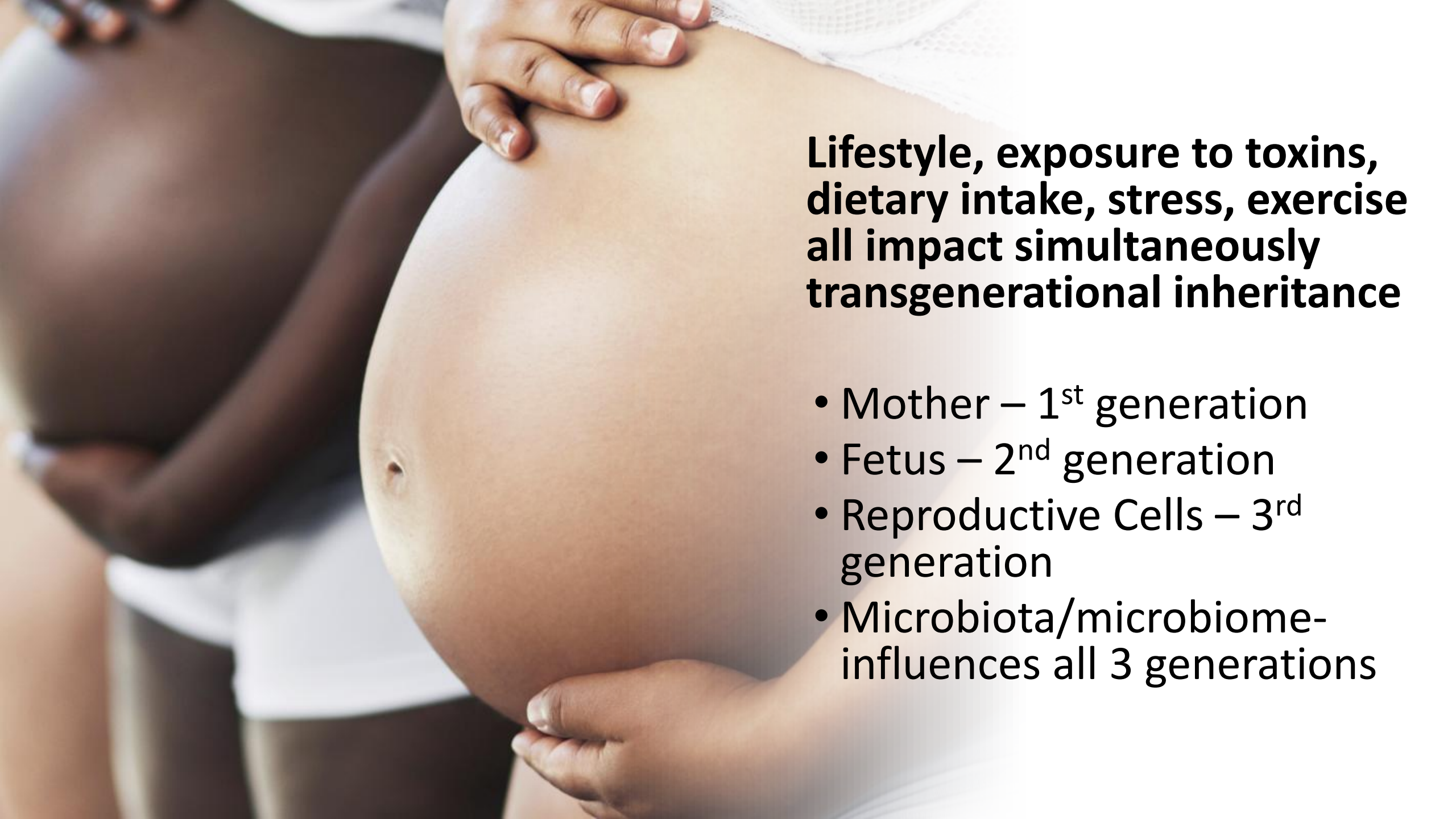




Lifestyle and Epigenetics

Lifestyle factors and epigenetic modifications

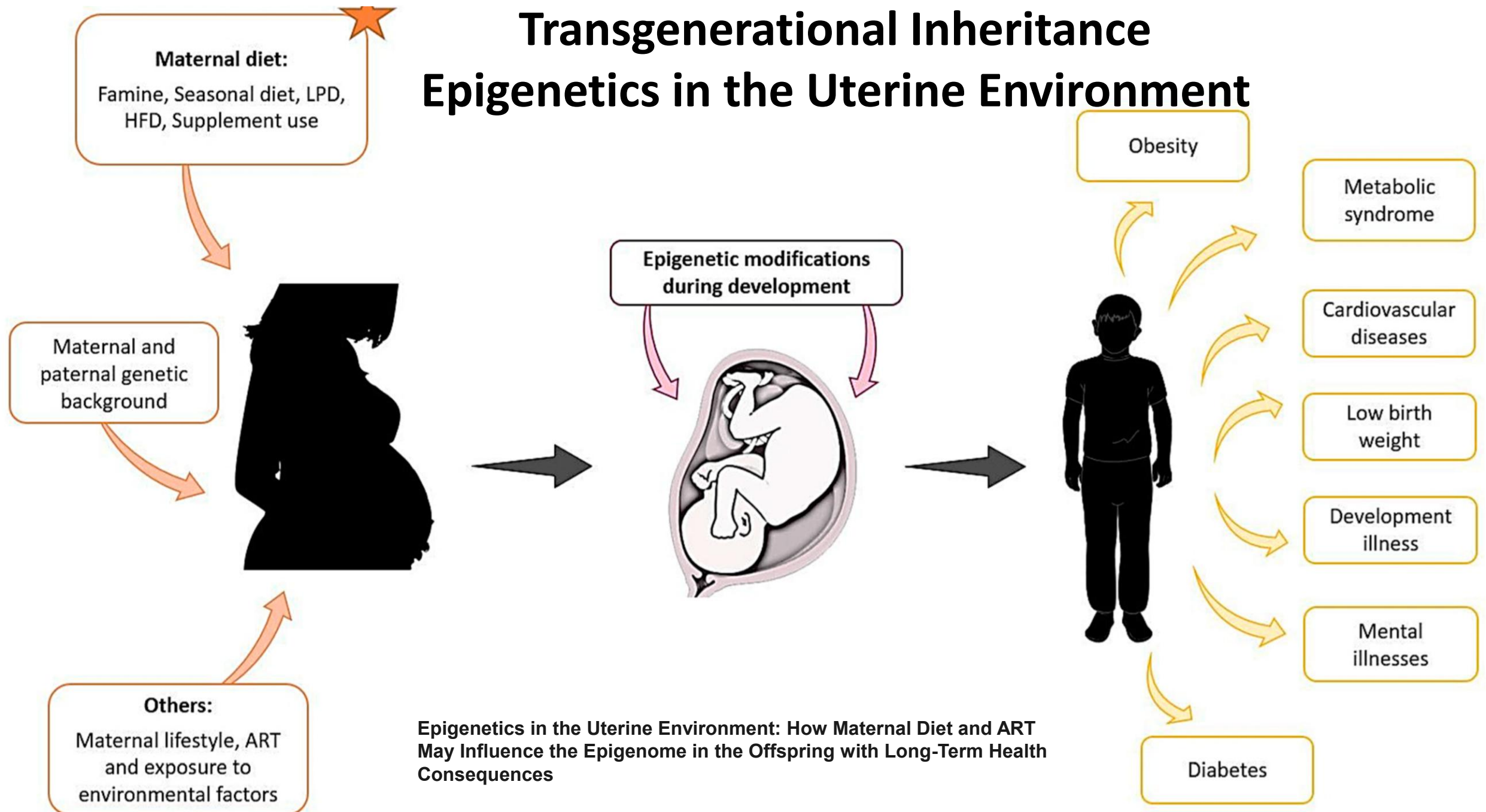




**Lifestyle, exposure to toxins,
dietary intake, stress, exercise
all impact simultaneously
transgenerational inheritance**

- Mother – 1st generation
- Fetus – 2nd generation
- Reproductive Cells – 3rd generation
- Microbiota/microbiome-
influences all 3 generations

Transgenerational Inheritance Epigenetics in the Uterine Environment



Epigenetics in the Uterine Environment: How Maternal Diet and ART May Influence the Epigenome in the Offspring with Long-Term Health Consequences

DNA Methylation in Cancer: Epigenetic View of Dietary and Lifestyle Factors

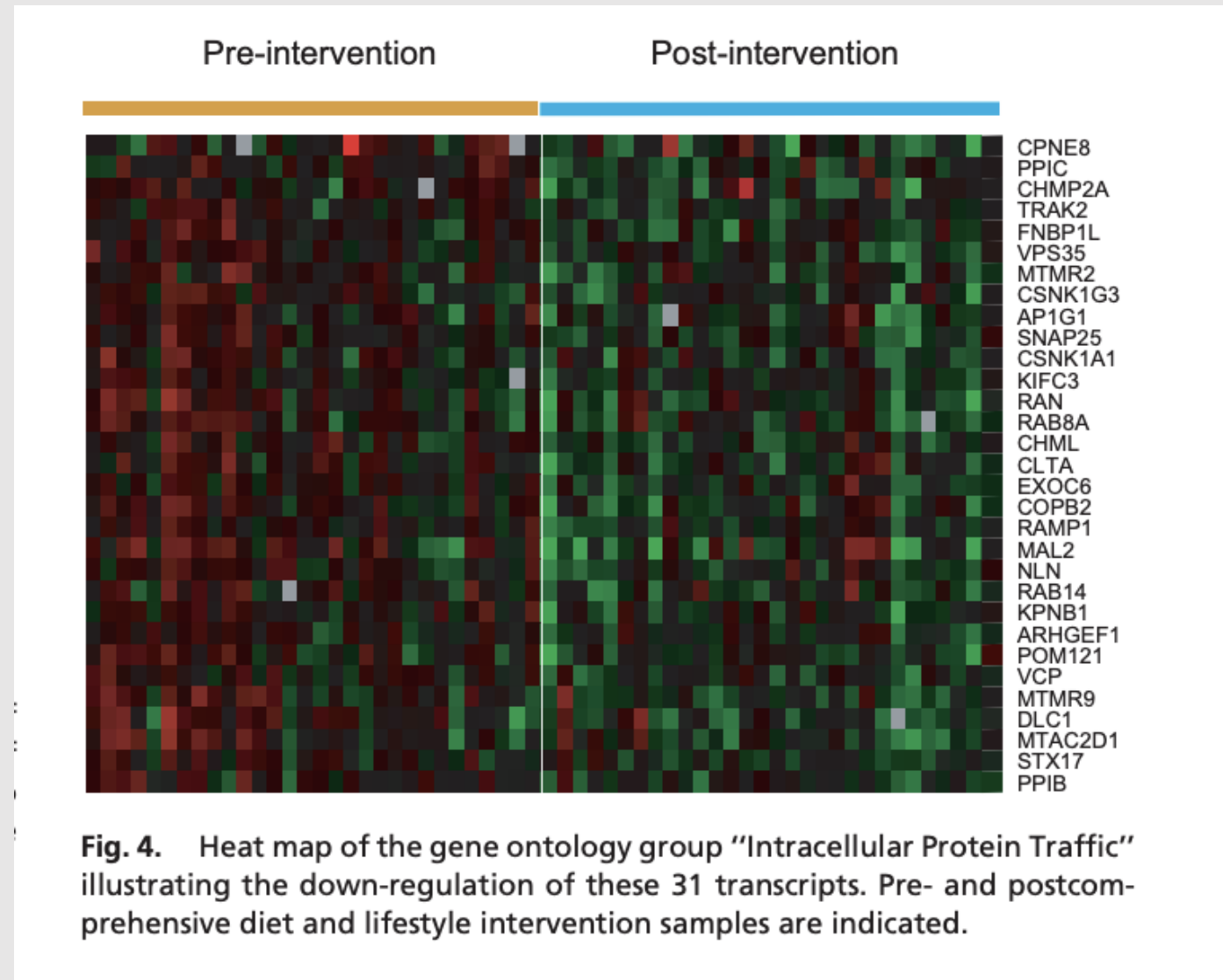
Lifestyle choices significantly impact cancer survival through epigenetic mechanisms, specifically by influencing DNA methylation, histone modifications, and microRNA expression

Dietary and lifestyle interventions aimed at modulating DNA methylation have potential for both cancer prevention and treatment through epigenetic mechanisms.

Changes in prostate gene expression in men undergoing an intensive nutrition and lifestyle intervention

Epidemiological and prospective studies indicate that comprehensive lifestyle changes may modify the progression of prostate cancer.

453 down-regulated transcripts after 30-day intensive lifestyle intervention



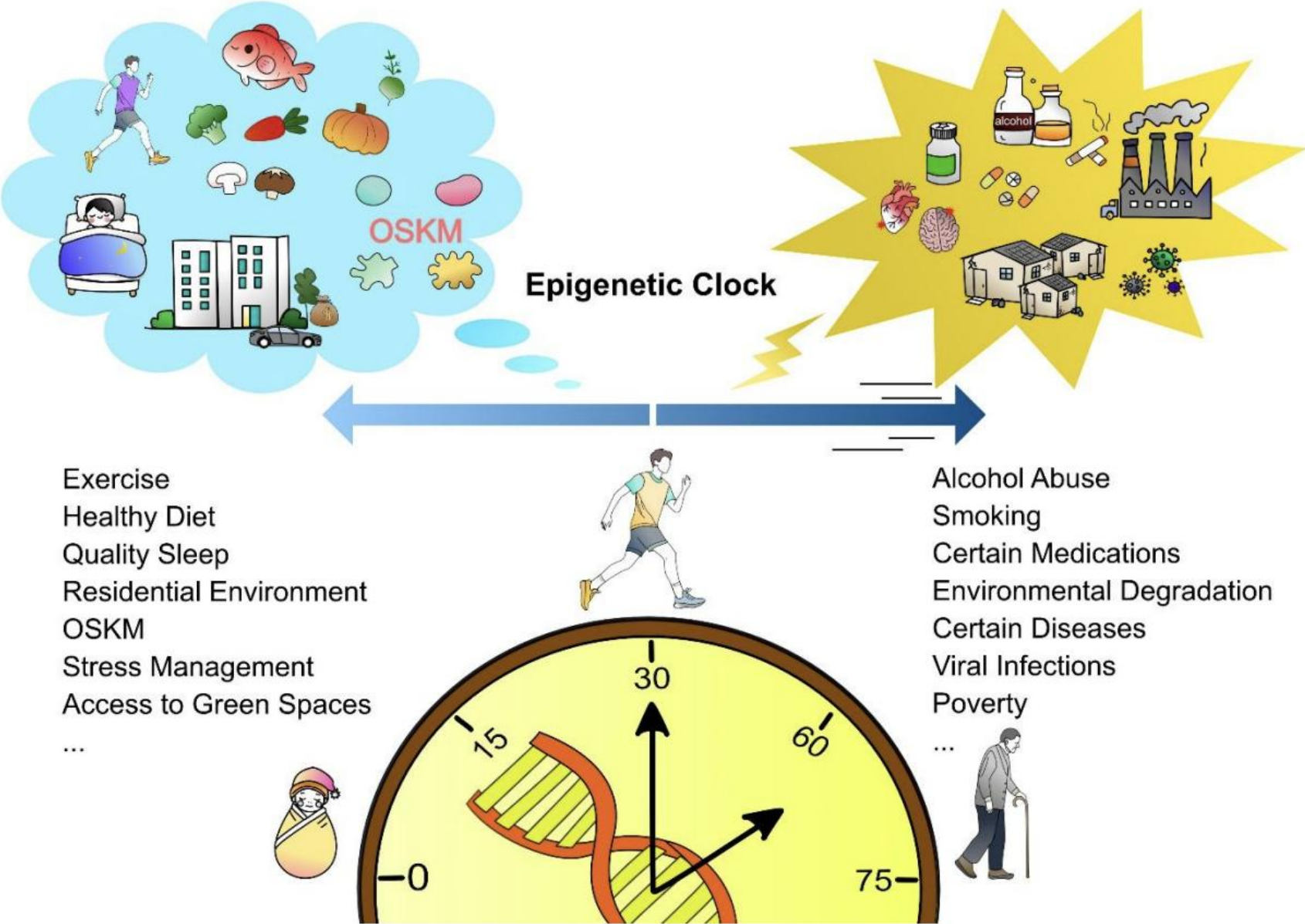




Epigenetic clocks, derived from DNA methylation patterns, are powerful aging biomarkers, capable of estimating biological age and assessing aging rates across diverse tissues with remarkable precision.

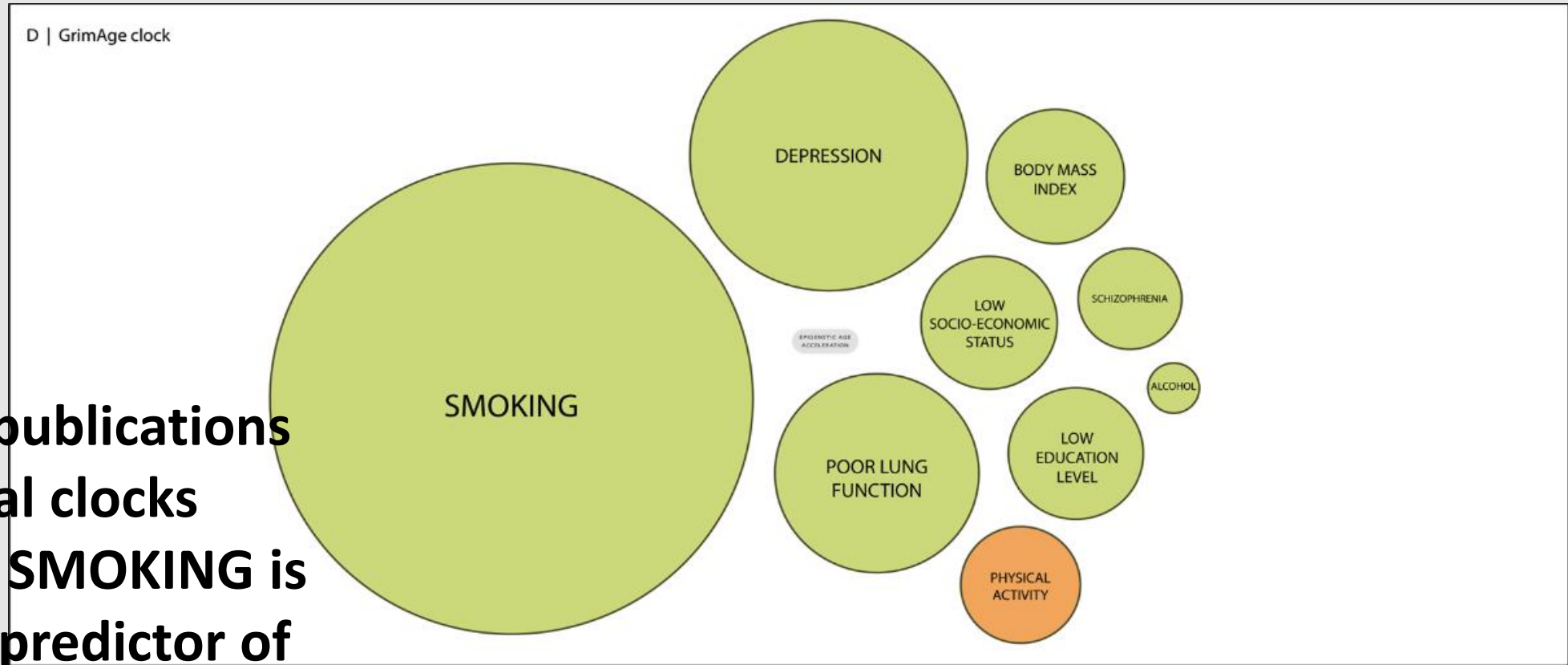
These clocks provide predictive insights into mortality and age-related disease risks, effectively distinguishing biological age from chronological age

Epigenetic Clocks: Beyond Biological Age, Using the Past to Predict the Present and Future





A systematic review of biological, social and environmental factors associated with epigenetic clock acceleration



Over 156+ publications on biological clocks report that **SMOKING** is the largest predictor of accelerated aging.

Major Lifestyle Recommendations For Increasing Healthspan and Reducing Biological Age

[Int J Environ Res Public Health](#). 2019 Jul; 16(13): 2356.

Published online 2019 Jul 3. doi: [10.3390/ijerph16132356](https://doi.org/10.3390/ijerph16132356)

PMCID: PMC6651499

PMID: [31277270](https://pubmed.ncbi.nlm.nih.gov/31277270/)

Smoking-Related DNA Methylation is Associated with DNA Methylation Phenotypic Age Acceleration: The Veterans Affairs Normative Aging Study

[Yang Yang](#),¹ [Xu Gao](#),² [Allan C. Just](#),³ [Elena Colicino](#),³ [Cuicui Wang](#),⁴ [Brent A. Coull](#),⁵ [Lifang Hou](#),⁶ [Yinan Zheng](#),⁶ [Pantel Vokonas](#),⁷ [Joel Schwartz](#),⁴ and [Andrea A. Baccarelli](#)^{2,*}

Smokers demonstrated a higher aging ratio, and both male and female smokers were predicted to be twice as old as their chronological age as compared to nonsmokers.

The results were carried out based on the blood profiles of 149,000 adults.





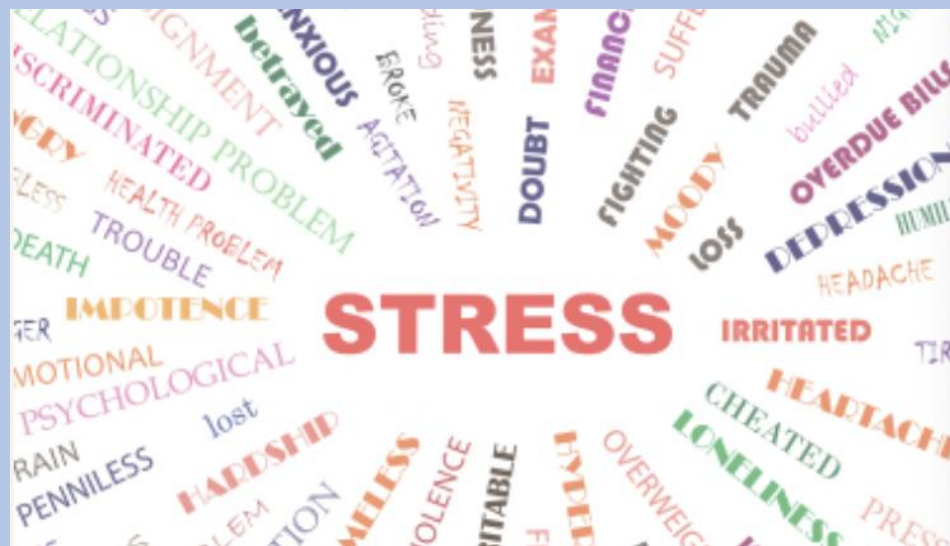
Cross-talk between gut microbiota and tobacco smoking: a two-sample Mendelian randomization study

[BMC Medicine](#) volume 21, Article number: 163 (2023)



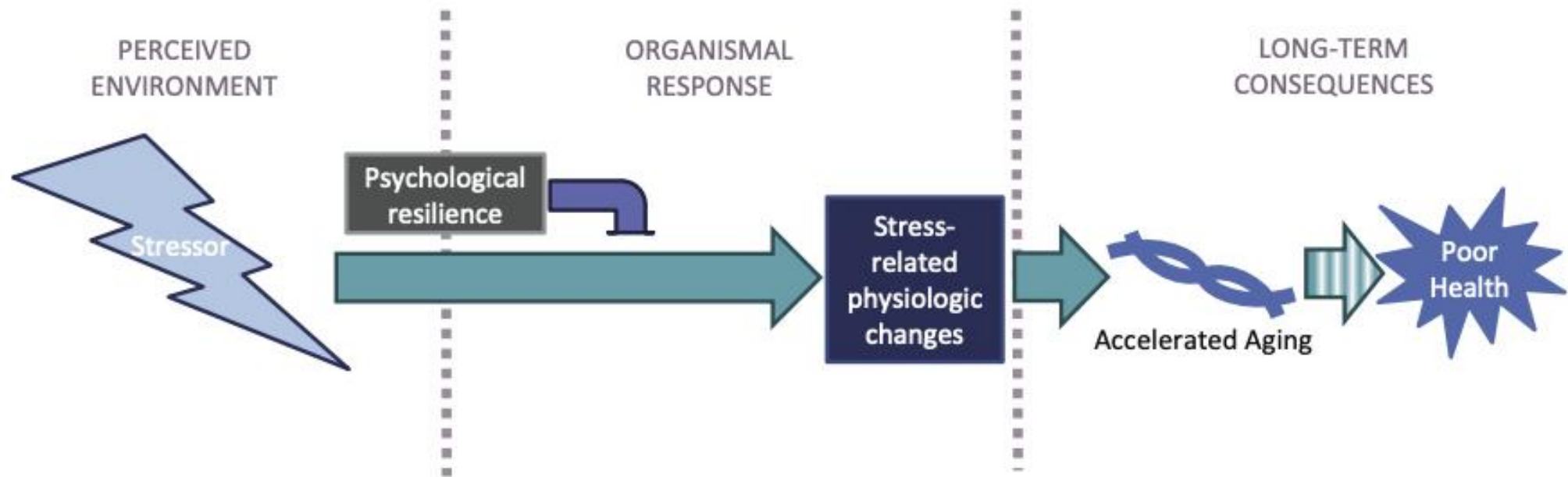
Smoking affects the gut microbiota by:

- Raising the pH of the intestinal environment
- Inducing chronic low-grade inflammation and inflammatory related diseases
- Promoting damaging oxidative stress which increases systemic inflammation



Psychological and biological resilience modulates the effects of stress on epigenetic aging

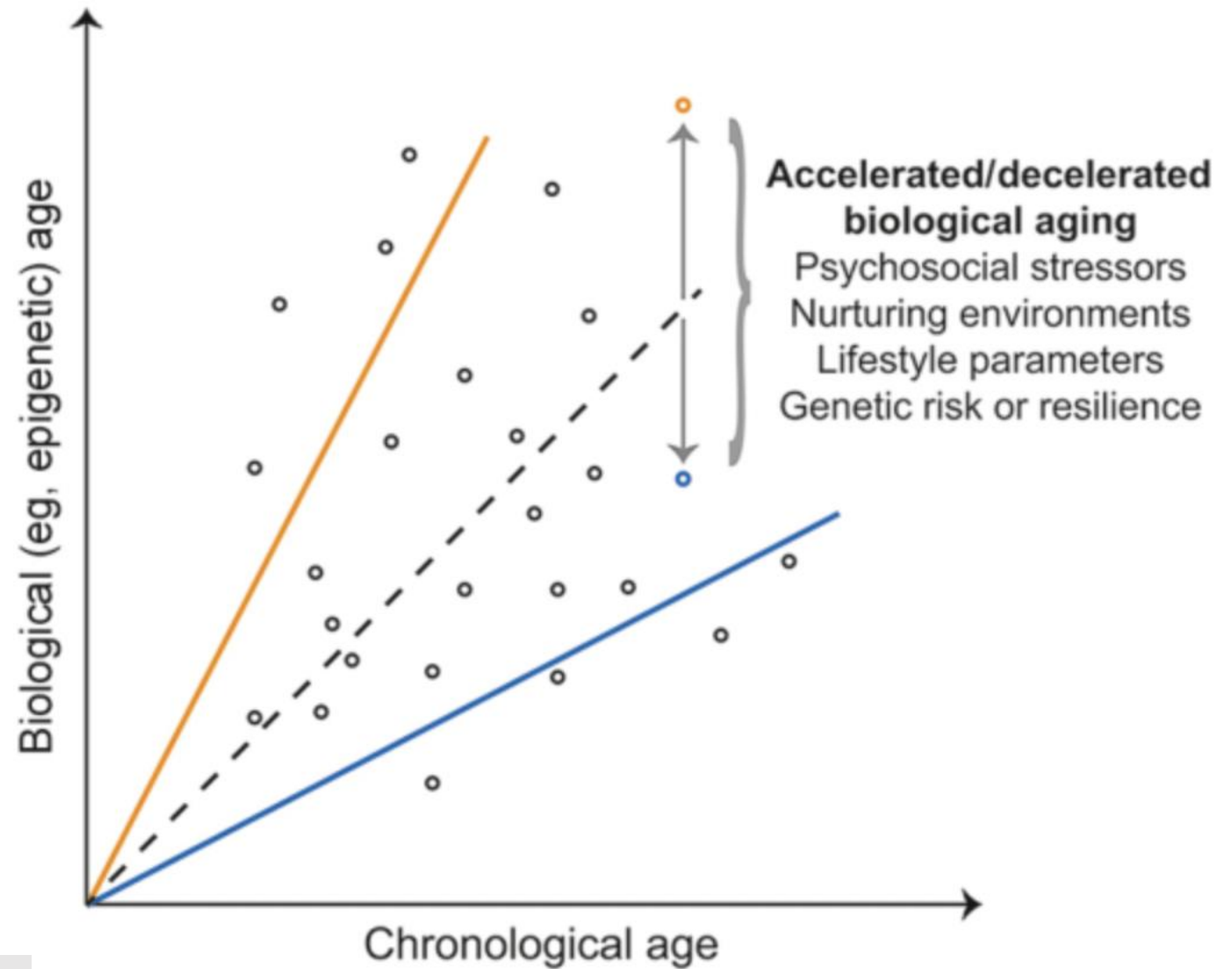
Translational Psychiatry (2021) 11:601



Model of relationships between cumulative stress, resilience, physiology, and aging.

Cumulative life-time stress
is associated with
accelerated epigenetic
aging

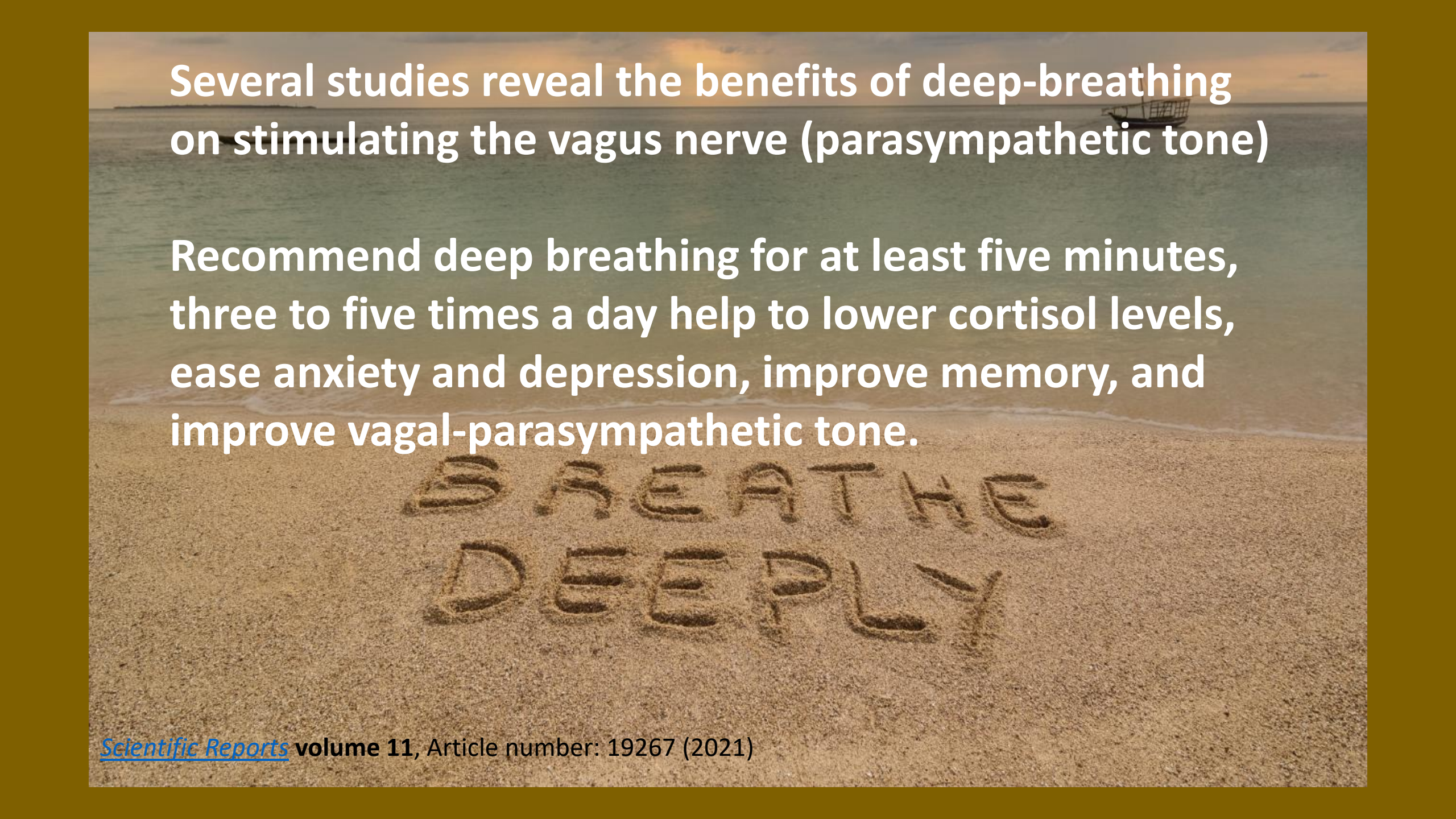
Personal life stress had
greater impact in older
compared to younger
participants



Dialogues Clin Neurosci. 2019 Dec; 21(4): 389–396.

Epigenetics as a key link between psychosocial stress and aging: concepts, evidence, mechanisms

Anthony S. Zannas, MD

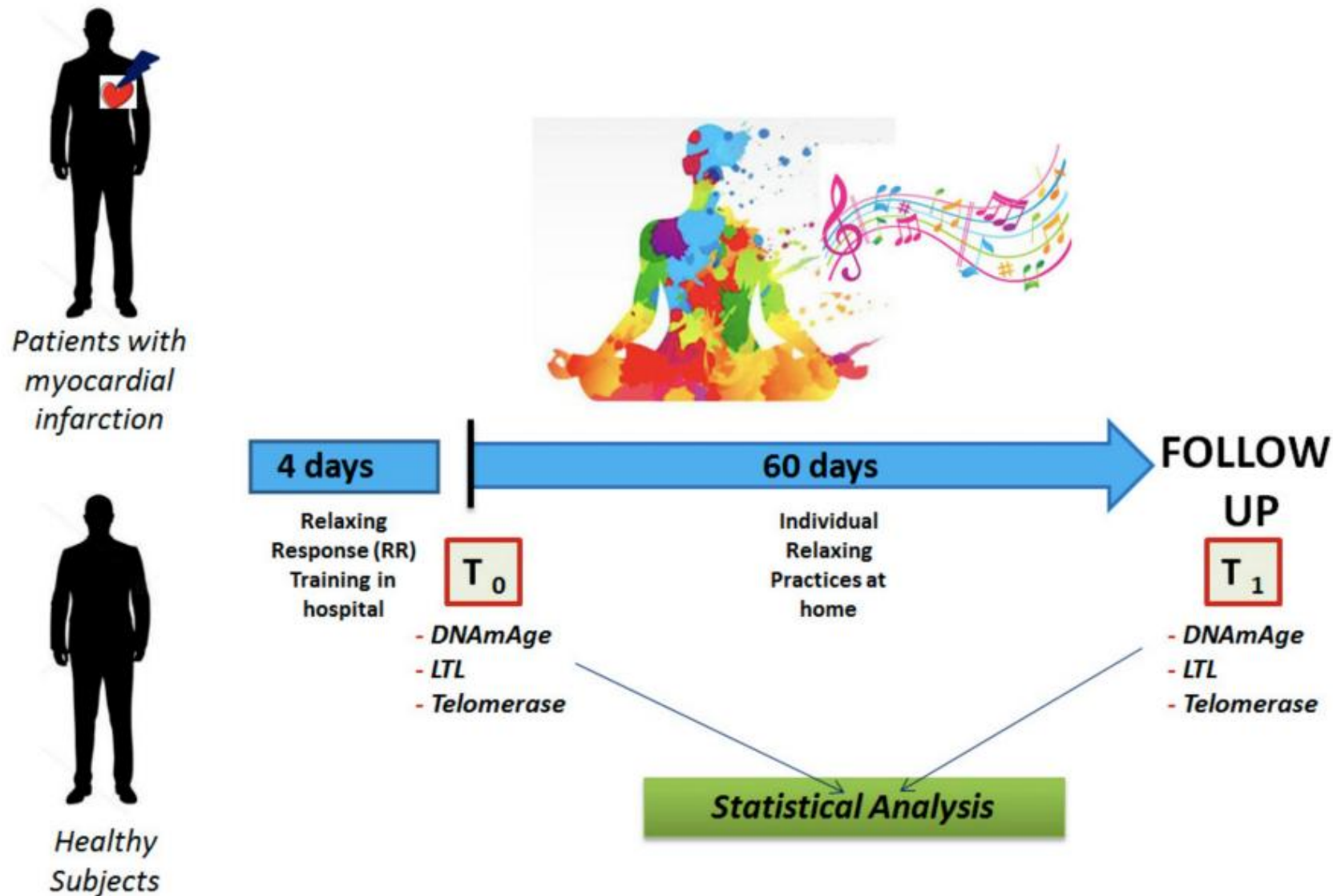


Several studies reveal the benefits of deep-breathing
on stimulating the vagus nerve (parasympathetic tone)

Recommend deep breathing for at least five minutes,
three to five times a day help to lower cortisol levels,
ease anxiety and depression, improve memory, and
improve vagal-parasympathetic tone.

BREATHE
DEEPLY

- **Studies published between 2013 and 2023.**
- **RCT Pranayama interventions with non-yoga control groups.**
- **Primary outcomes, including psychological well-being, quality of life, physiological parameters, and treatment-related side effects.**
- **Pranayama has been shown to be an effective complementary therapy for cancer patients, enhancing their well-being and quality of life**



Exploring Epigenetic Age in Response to Intensive Relaxing Training: A Pilot Study to Slow Down Biological Age

Int. J. Environ. Res. Public Health 2019, 16, 3074; doi:10.3390/ijerph16173074

Epigenetic clock analysis in long-term meditators

A 2017 study found that long-term meditators (ages 52 and older) were protected from the accelerated epigenetic aging that was observed in non-meditating controls in the same age group.

The mechanisms by which pranayama is thought to influence the epigenetic clock are largely linked to its effects on stress reduction and cellular health.

- Reduced oxidative stress
- Reduced systemic inflammation
- Modulation of the autonomic nervous system's stress response
- Support for increasing telomere length

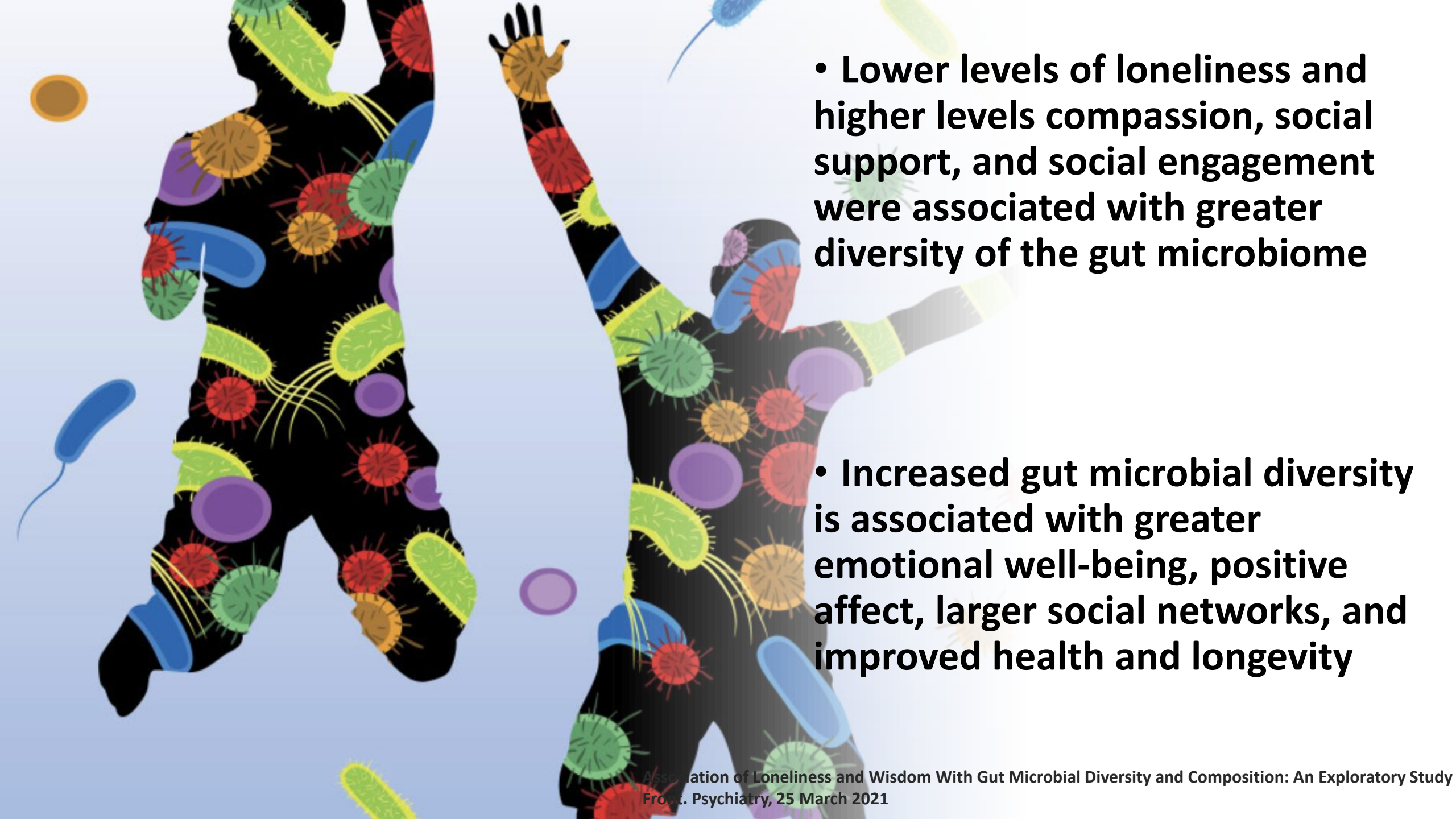
Social Connection



Social connection, whether with other people or through “compassionate attention” to yourself, is one of the most important ways to activate the vagal parasympathetic network.



- **23 meta-analyses published between 1994 and 2021, which include 1,187 longitudinal and cross-sectional studies with more than 1,458 million participants**
- **Loneliness is comparable to smoking up to 15 cigarettes a day**
- **Low social support is a significant predictor of inflammation.**
- **Chronic inflammation associated with low social integration impacts multiple diseases that represent the leading causes of disability and mortality worldwide: cardiovascular disease, cancer, diabetes mellitus, CKD, NAFLD, and autoimmune and neurodegenerative disorders.**

An illustration featuring two black silhouettes of human figures against a light blue background. The silhouettes are filled with various colorful, stylized microbes, including red, green, yellow, and purple spheres, some with spiky surfaces, and blue and yellow elongated shapes. Some microbes have long, thin flagella. The figures are positioned as if they are reaching upwards, with their arms raised. The overall theme is the connection between gut microbiome diversity and human health.

- Lower levels of loneliness and higher levels compassion, social support, and social engagement were associated with greater diversity of the gut microbiome

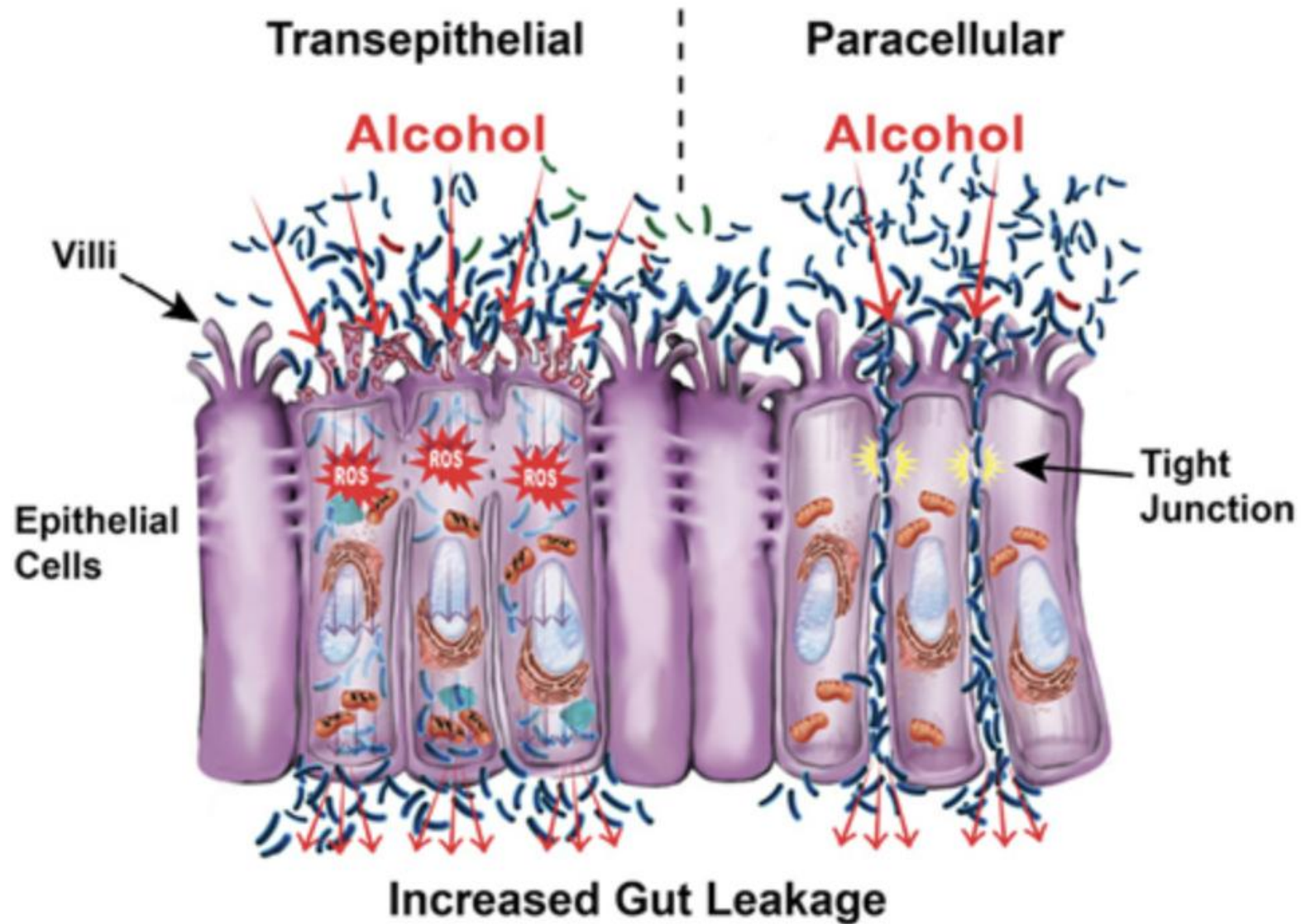
- Increased gut microbial diversity is associated with greater emotional well-being, positive affect, larger social networks, and improved health and longevity



Epigenetic aging is accelerated in alcohol use disorder and regulated by genetic variation in APOL2

Neuropsychopharmacology (2020) 45:327 – 336

- **Epigenetic clock alcohol study on 331 individuals with Alcohol Use Disorder (AUD) and 201 healthy controls.**
- **Heavy, chronic alcohol consumption caused epigenetic age acceleration (EAA)**



Alcohol and Intestinal Microbiota studies show that alcohol promotes both dysbiosis and bacterial overgrowth which in turn leads to an increase in the release of endotoxins, produced by gram-negative bacteria



RESEARCH NOTE

Open Access



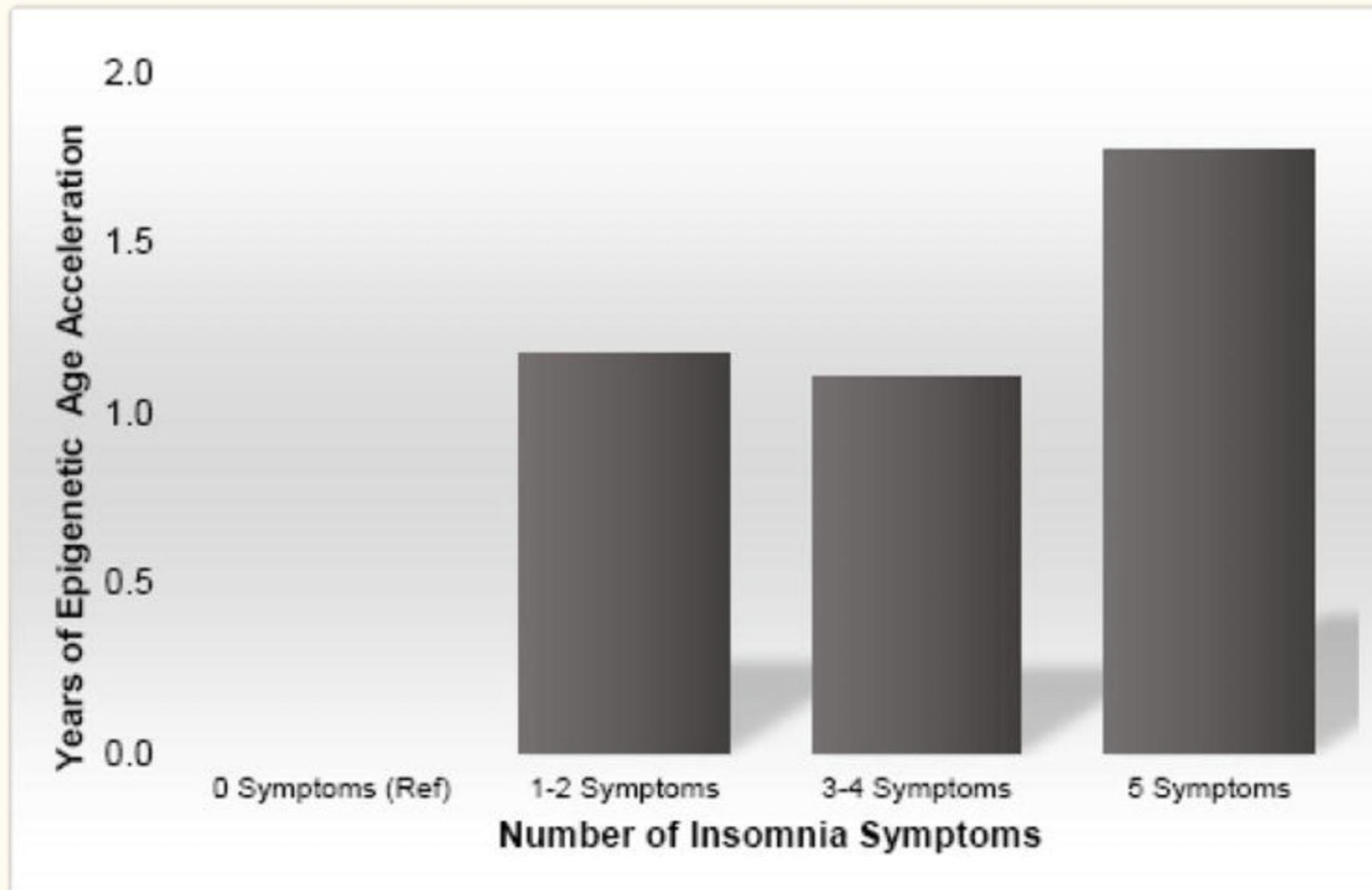
A pilot prospective study of sleep patterns and DNA methylation-characterized epigenetic aging in young adults

Mary A. Carskadon^{1,2*}, Kenneth R. Chappell⁵, David H. Barker^{2,3}, Anne C. Hart⁴, Kayla Dwyer⁵, Caroline Gredvig-Ardito¹, Caitlyn Starr⁵ and John E. McGeary^{2,5}

- **Poorer sleep was associated with marked acceleration of epigenetic aging while better sleep was associated with decelerated epigenetic aging**
- **Participants with longer and more regular sleep showed reduced age difference by 2.48 years**
- **Those with shorter and more irregular sleep showed an increased age difference by 4.13 years**

Epigenetic aging and immune senescence in women with insomnia symptoms: Findings from the Women's Health Initiative Study

[Biol Psychiatry. 2017 Jan 15; 81\(2\): 136–144.](#)





Physical Activity Is Associated With Decreased Epigenetic Aging: Findings From the Health and Retirement Study

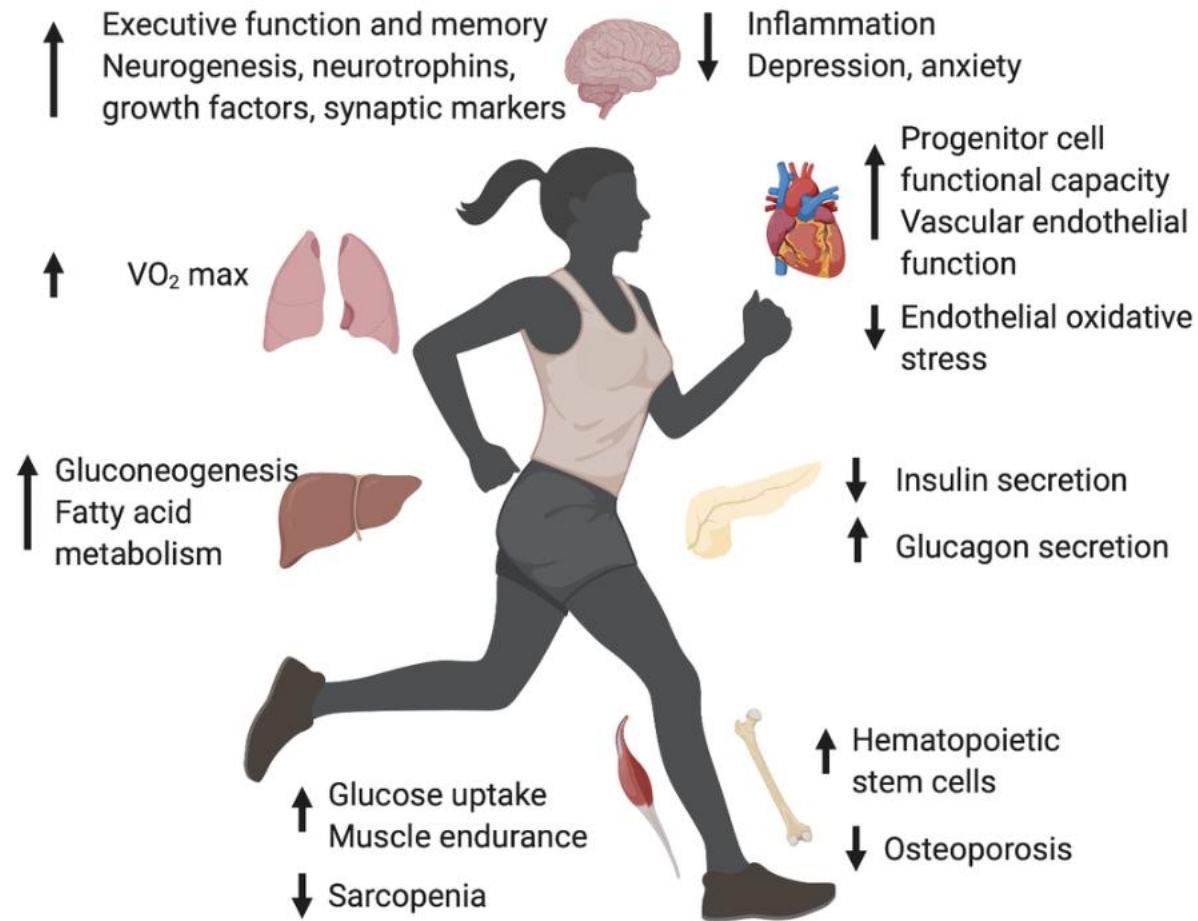
ABSTRACT

Background: Epigenetic aging measures or clocks are DNA methylation-based indicators of biological aging, linked to health outcomes and disease risk. Physical activity and exercise may influence epigenetic aging, suggesting a pathway through which it promotes healthier aging and reduces chronic disease burden. In this study, we assessed the association between self-reported moderate-to-vigorous physical activity and epigenetic age acceleration (EAA) in participants of the Health and Retirement Study, followed biennially for 12 years from 2004 to 2016.

Methods: Leukocyte DNA methylation was measured from venous blood samples collected in 2016 and second-generation epigenetic clocks were used to estimate EAA. Findings highlight that both sustained and recent physical activity were significant independent predictors of slower epigenetic aging.

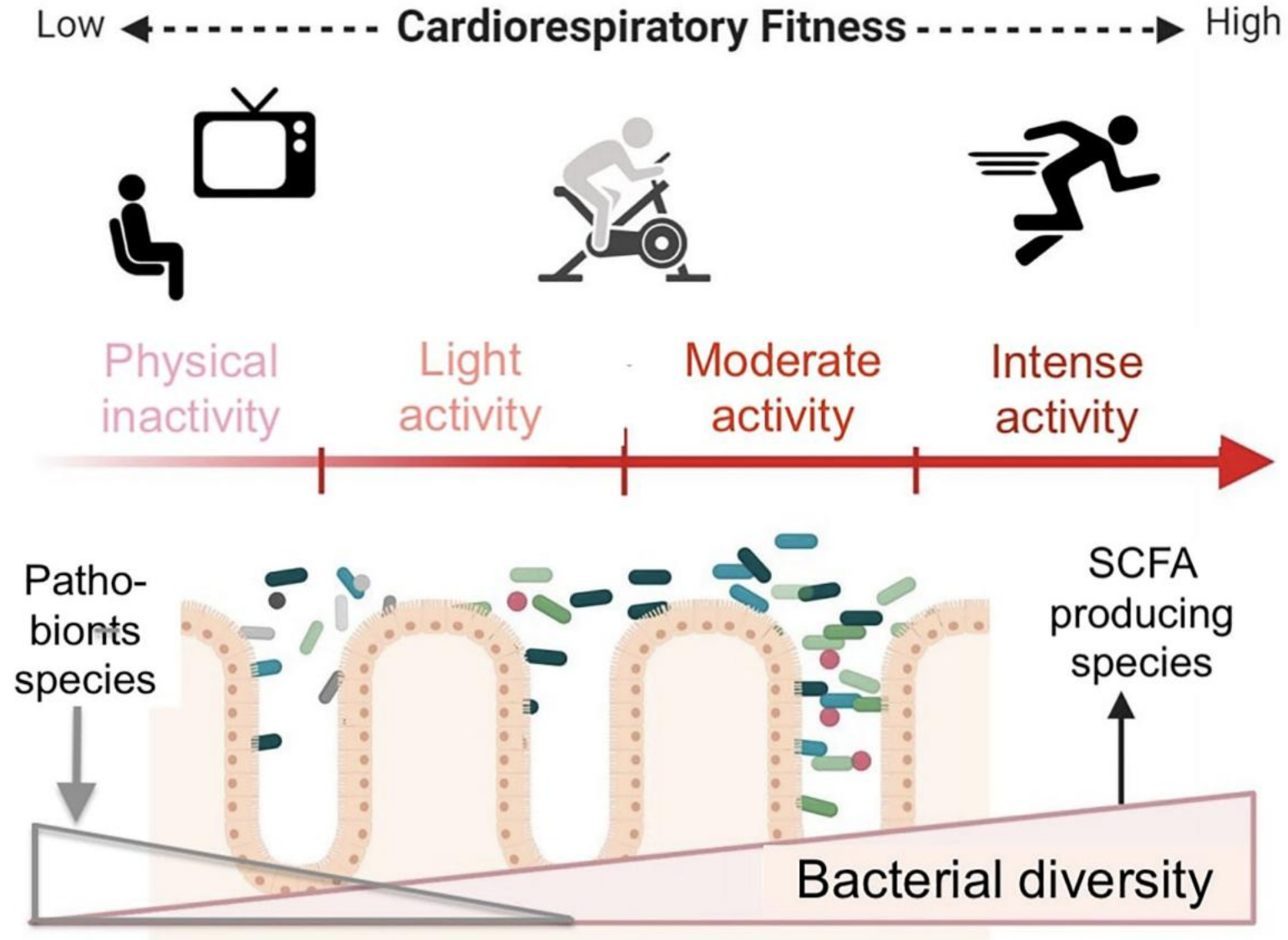
Results: In 2016, 58% of the participants were classified as physically active. In cross-sectional analysis, physically active participants had lower EAA than inactive participants: -1.26 (95% confidence interval (CI): $-1.59, -0.93$) years for GrimAge acceleration, -1.70 (95% CI: $-2.26, -1.15$) for PhenoAge acceleration and -0.05 (95% CI: $-0.06, -0.04$) years per chronological year for DunedinPACE, adjusted for age, gender, race/ethnicity, education, total wealth and current smoking status. The associations attenuated slightly but remained significant after further adjusting for body mass index, mobility limitations and chronic disease diagnosis. We found evidence of effect modification in the association between physical activity and EAA by social factors, with stronger associations in males compared to females for DunedinPACE ($P_{\text{interaction}} = 0.04$) and a positive association between physical activity and increased EAA among Hispanics compared to non-Hispanic Whites for GrimAge ($P_{\text{interaction}} = 0.009$). Our longitudinal analysis using SLCMA identified both accumulation and most recent physical activity in 2016 as the strongest predictors of EAA.

Conclusions: Our findings highlight physical activity as a robust factor associated with slower epigenetic aging, with both accumulation and concurrent physical activity as the strongest predictors. These results underscore the role of physical activity in promoting healthier biological aging, suggesting its potential as a target for interventions aimed at mitigating age-related health decline.



**Longevity effects: exercise >150 but <2000 minutes/week.
Combination of aerobic and resistance exercise**

Progressive increase of physical activity level generates changes in the intestinal microbiota





Food Is Medicine ”

Higher diet quality relates to decelerated epigenetic aging

Am J Clin Nutr 2022;115:163–170.

Higher diet quality is associated with slower epigenetic age acceleration, and has beneficial effects on lifespan and health span.

Findings emphasize that adopting a healthy diet, mostly whole plants, is crucial for maintaining healthy aging.

Advantages of the DASH diet

- Low in salt and sodium
- Rich in fresh fruits and vegetables
- Rich in low fat or nonfat dairy products
- Rich in whole grains, beans, seeds and nuts
- Fish and poultry (low in red meat)
- Rich in heart healthy fats
- Rich in potassium and calcium
- Low in added sugars and sweets
- Avoid foods with additives/preservatives

Advantages of the Mediterranean diet

- Primarily plant-based foods, such as fruits, vegetables, whole grains, legumes and nuts
- Replacing butter with healthy fats, such as olive oil and canola oil
- Using herbs and spices instead of salt to flavor foods
- Limiting red meat to no more than a few times a month
- Eating fish and poultry at least twice a week
- Enjoying meals with family and friends
- Drinking red wine in moderation (optional; one glass for women, one to two for men)
- Emphasizes fresh foods, no packaged or processed foods
- Advocates for getting plenty of exercise

Carotenoids Are Associated With A Younger Epigenetic Age And A Reduced All-Cause Mortality Risk

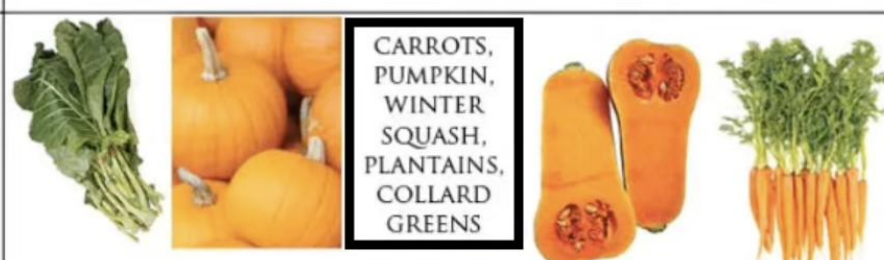
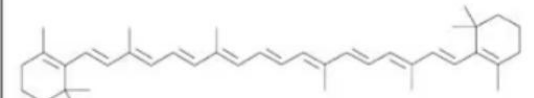
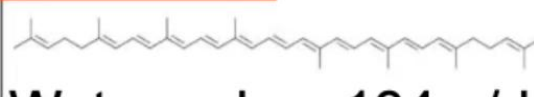
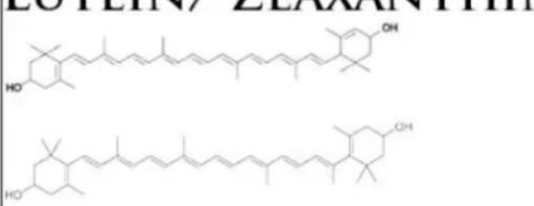
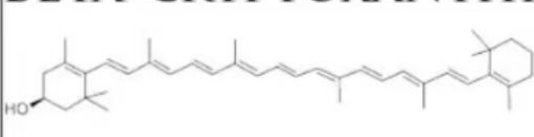
TYPE	CAROTENOID FOOD SOURCES
ALPHA-CAROTENE  Carrots: 416 g/d	 CARROTS, PUMPKIN, WINTER SQUASH, PLANTAINS, COLLARD GREENS
BETA-CAROTENE  Carrots: 416 g/d	 CARROTS, LEAFY GREENS, SWEET POTATO, CANTALOUPE, PUMPKIN
LYCOPENE  Watermelon: 134 g/d	 TOMATOES, PAPAYA, GRAPEFRUIT, WATERMELON
LUTEIN/ ZEAXANTHIN 	 LEAFY GREENS, SUMMER/ WINTER SQUASH, BRUSSEL SPROUTS, YELLOW CORN
BETA-CRYPTOXANTHIN 	 PUMPKIN, PAPAYA, SWEET PEPPER, ORANGE, CARROT

Image via shorturl.at/euLS

Polyphenols





Available online at www.sciencedirect.com

Journal of Future Foods

Journal of Future Foods 3-4 (2023) 289–305

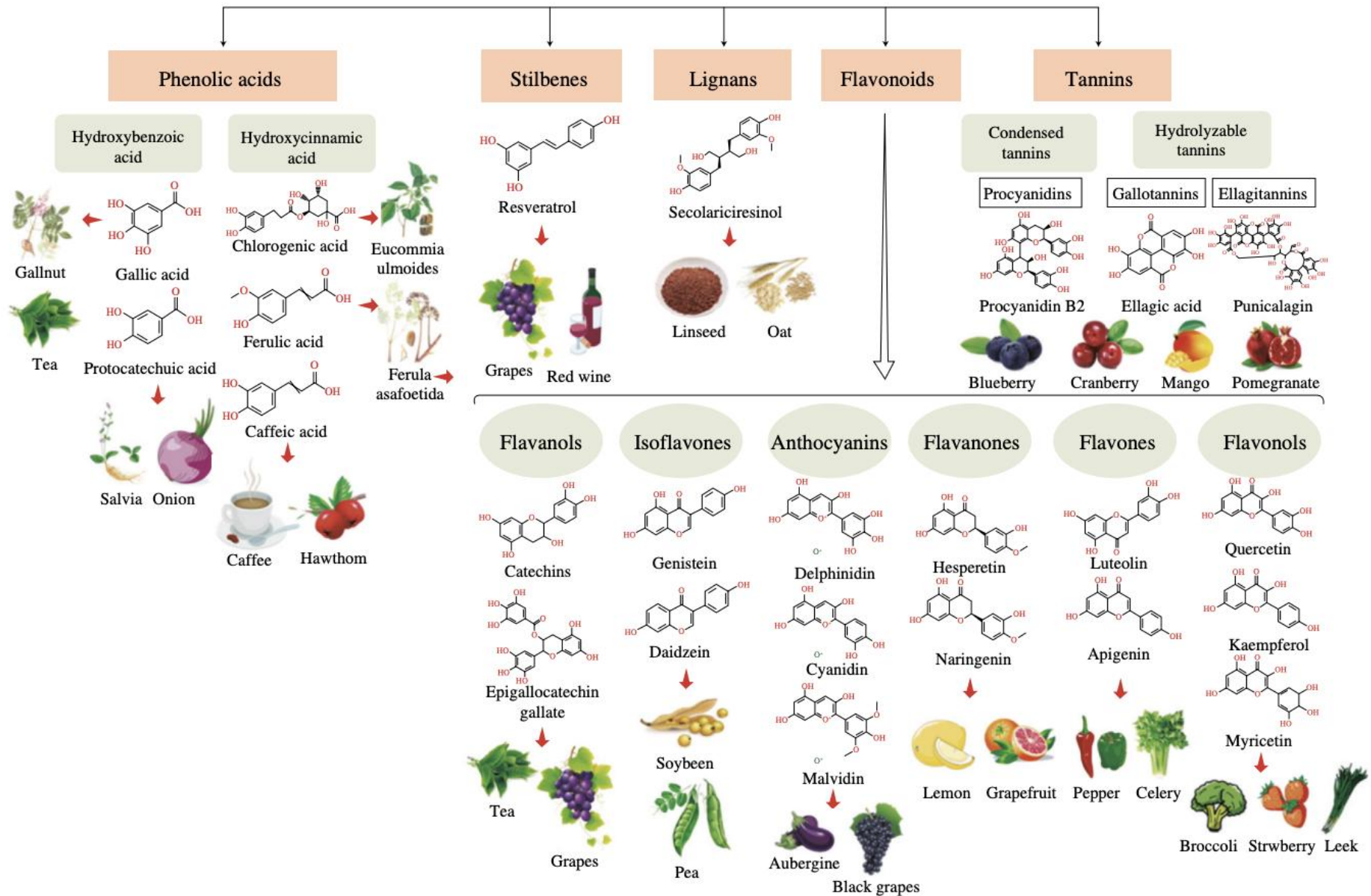
journal homepage: <http://www.keaipublishing.com/en/journals/journal-of-future-foods>



Research progress on classification, sources and functions of dietary polyphenols for prevention and treatment of chronic diseases

Dietary polyphenols are the most abundant antioxidants in daily diet and widely distributed in plants and plant-based foods, including vegetables, fruits, cereals, nuts, and beverages (e.g., tea, coffee, red wine). Over the past decades, there has been rising scientific interest in their diverse benefits to human health, since dietary polyphenols display various bioactivities, such as antioxidant activity, anti-inflammatory activity, anti-cancer, anti-microbial activity, neuro-protective activity, among others. Various studies have demonstrated that diet with polyphenols is strongly related to decrease the risk of chronic diseases

Dietary Polyphenols





FRUITS & VEGETABLES

Apples, Berries, broccoli, carrots, grapes, lettuce, tomatoes



HERBS & SPICES

Caraway, celery seed (dried), cinnamon, cloves, common sage, curry (powder), ginger (dried), Mexican oregano, parsley (dried), peppermint (dried), red chicory, rosemary(dried), spearmint (dried), star anise, sweet basil (dried), and thyme



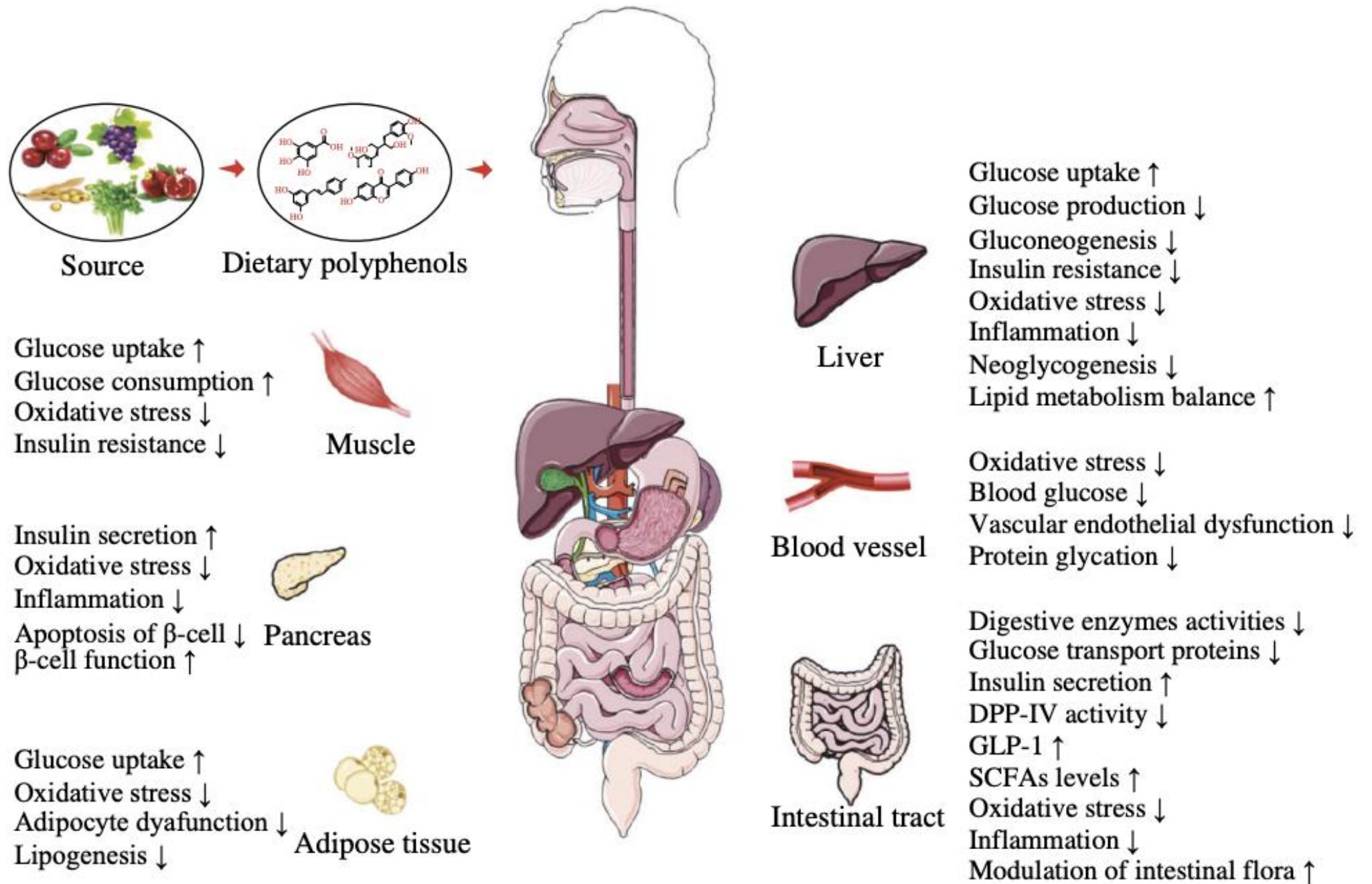
OTHER FOODS

Cacao, cocoa powder, dark chocolate, flaxseed meal, olive oil, olives



DRINKS

Beer, coffee, teas (black, green, oolong), and wine



The effect of polyphenols on DNA methylation-assessed biological age attenuation: the DIRECT PLUS randomized controlled trial

Eat Your Greens

| Increased Dietary Polyphenols Slow the Epigenetic Aging Process

As reported in *Clinical Epigenetics* ([Yaskolka Meir and Keller et al.](#)), the team employed a variety of [DNA methylation](#)-based

Discover that **greater adherence to the green-Mediterranean diet richer in polyphenols prompted the more significant slowing of DNA methylation-based epigenetic aging when measured by the Li ([Li et al.](#)) and Hannum ([Hannum et al.](#))**

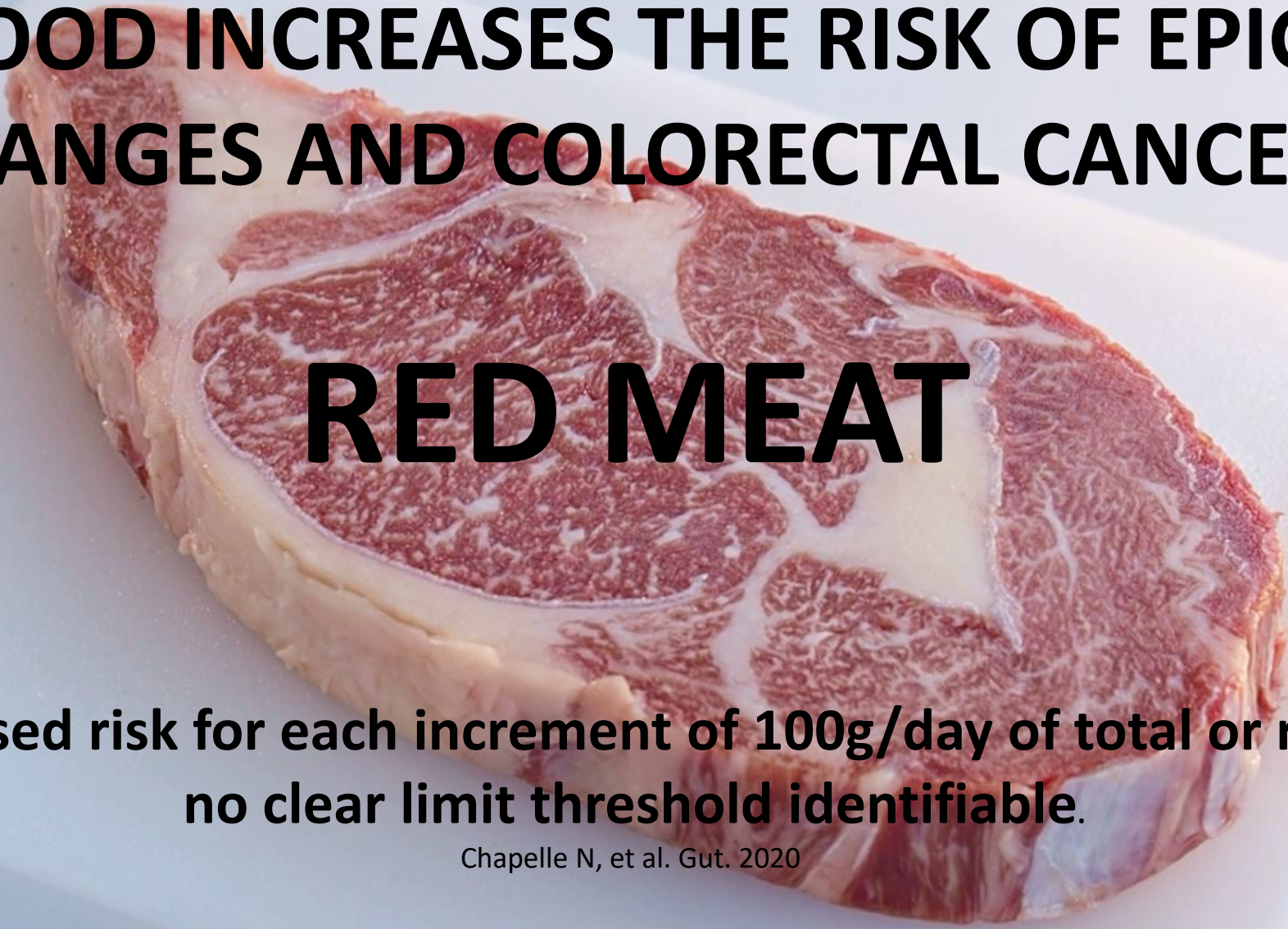
epigenetic clocks. Greater intake of polyphenols from sources such as green plant products induced more significant DNA methylation-based epigenetic age attenuation according to the Li epigenetic clock, which corresponded to increased levels of polyphenols such as hydroxytyrosol, tyrosol, urolithin C, and urolithin A in the urine. Additionally, the dietary changes evaluated in this clinical trial prompted beneficial effects on multiple health conditions (e.g., fatty liver, age-related brain atrophy, and cardiovascular risk), which may contribute to healthy aging, and supported weight loss in each intervention group

Dietary polyphenols influence gut microbiota composition in the host, maintain intestinal barrier integrity, improving the host's metabolism.

Microbiota metabolize polyphenols into bioactive metabolites that modulate the host's regulatory metabolism network, thus reducing inflammation and chronic disease risk.



WHAT FOOD INCREASES THE RISK OF EPIGENETIC CHANGES AND COLORECTAL CANCER?



RED MEAT

**10–30% increased risk for each increment of 100g/day of total or red meat, with
no clear limit threshold identifiable.**

Chapelle N, et al. Gut. 2020

A Plant-Forward Diet reduces the risk of CRC

- 123 773 participants of the Nurses' Health Study and the Health Professionals Follow-up Study
- (3 143 158 person-years)
- 3077 of them had developed CRC.
- Healthy and unhealthy plant-based diet indices were calculated using repeated food frequency questionnaire data.
- An unhealthy UP plant-based diet is associated with higher CRC incidence.
- A healthy plant-based diet rich in whole grains, fruits and vegetables is associated with lower incidence of CRC
- Replacing refined grains with healthy plant foods such as whole grains, fruits and vegetables is associated with lower CRC incidence.

**High dietary adherence alone associated with:
44 - 80% reduced risk colorectal cancer**

WHO classification of red and processed meats

IARC* Carcinogenic classification groups

Causes cancer

1

Probably causes cancer

2a

Possibly causes cancer

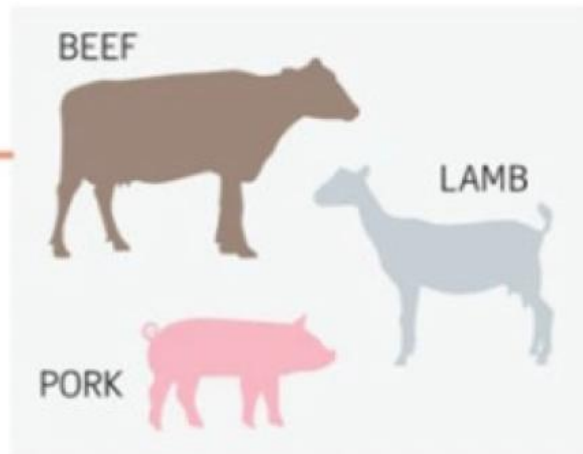
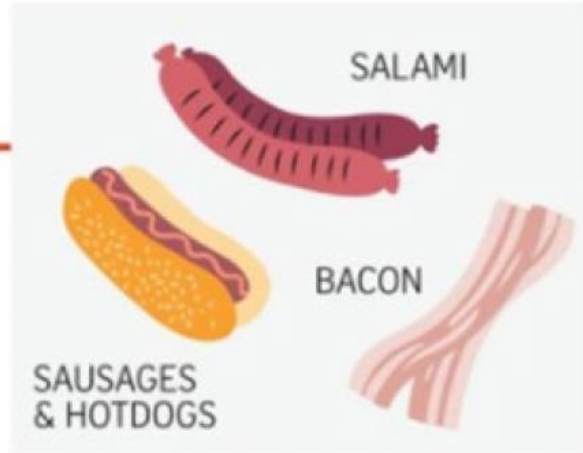
2b

Not classifiable as a cause of cancer

3

Probably not a cause of cancer

4



* International Agency for Research on Cancer

The Washington Post

Democracy Dies in Darkness

ECONOMIC POLICY

Hot dogs, bacon and other processed meats cause cancer, World Health Organization declares



By Peter Whoriskey

October 26, 2015 at 6:15 a.m. EDT



America's bacon obsession is more unhealthy than we thought

0:52

A new World Health Organization study found that processed meat like bacon and hot dogs cause cancer. It is the most prominent group to declare it a cause. (Video: Jenny Starns/The Washington Post)

IARC, 2015

Fat, Fiber and Cancer Risk in African Americans and Rural Africans

Plant-based diet rapidly reverses harmful changes

Within 14 days of switching from Standard American Diet to high-fiber plant-based diet:

“Remarkable reciprocal changes in mucosal biomarkers of cancer risk in aspects of the microbiota and metabolome known to affect cancer risk”

- More beneficial SCFAs
- Less carcinogenic secondary bile acids
- Reduced mucosal proliferation rate

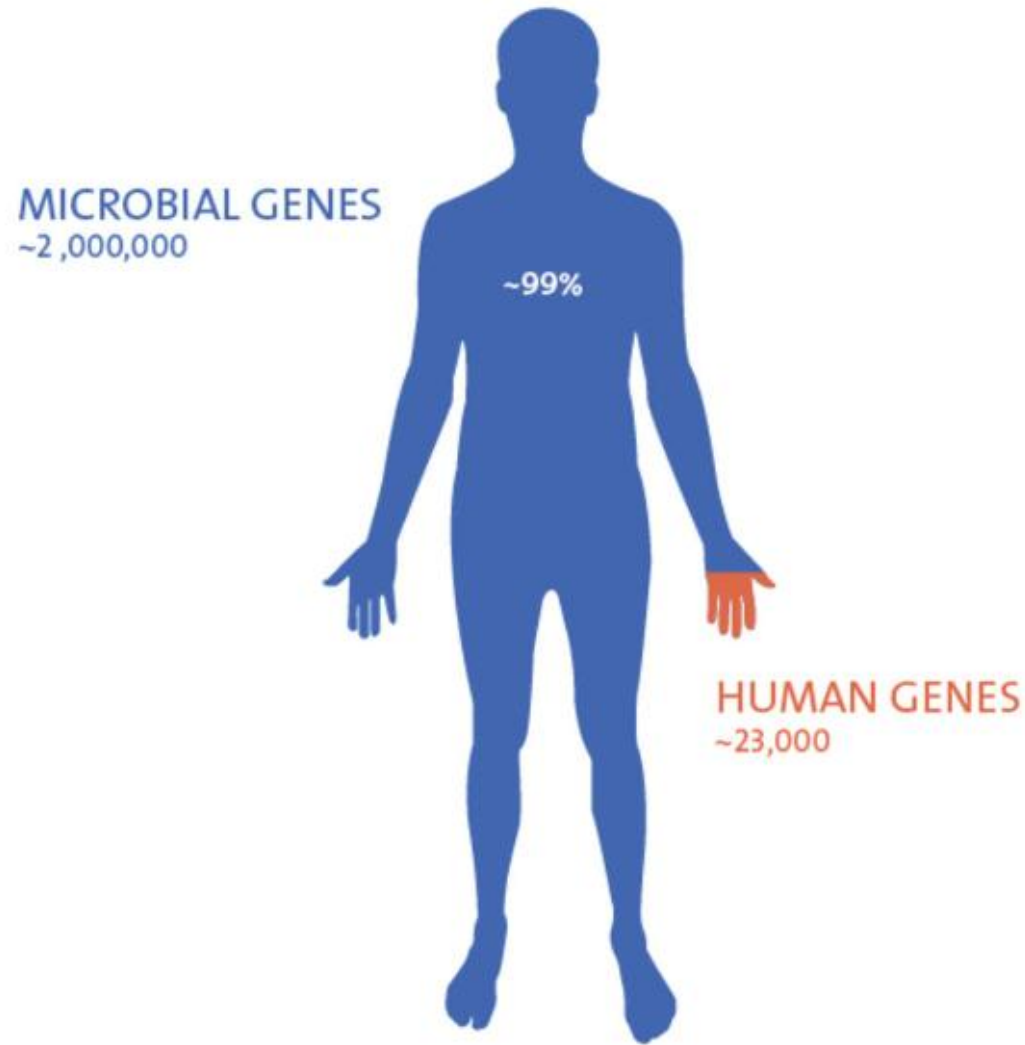




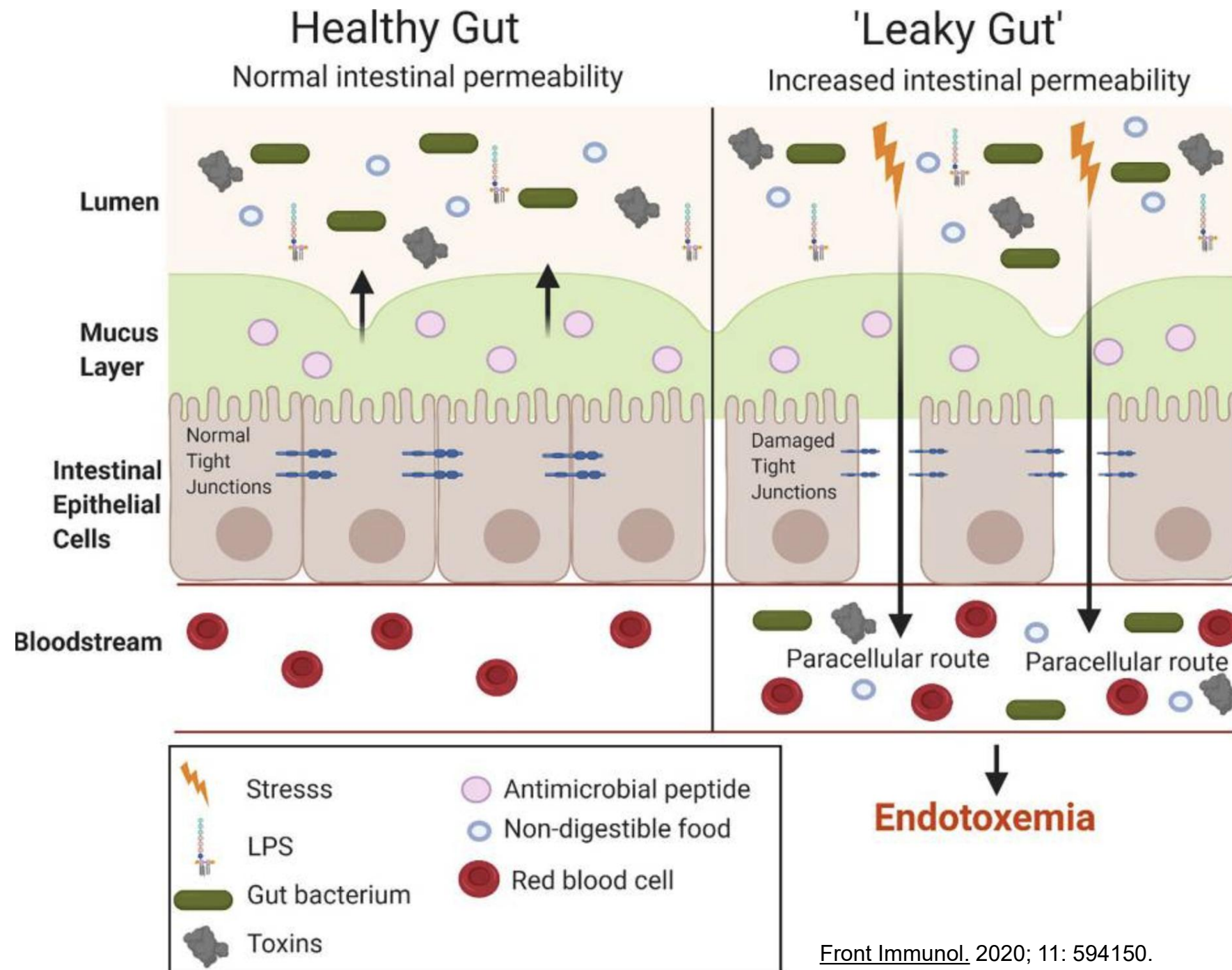
ALL DISEASE BEGINS IN THE GUT

HIPPOCRATES

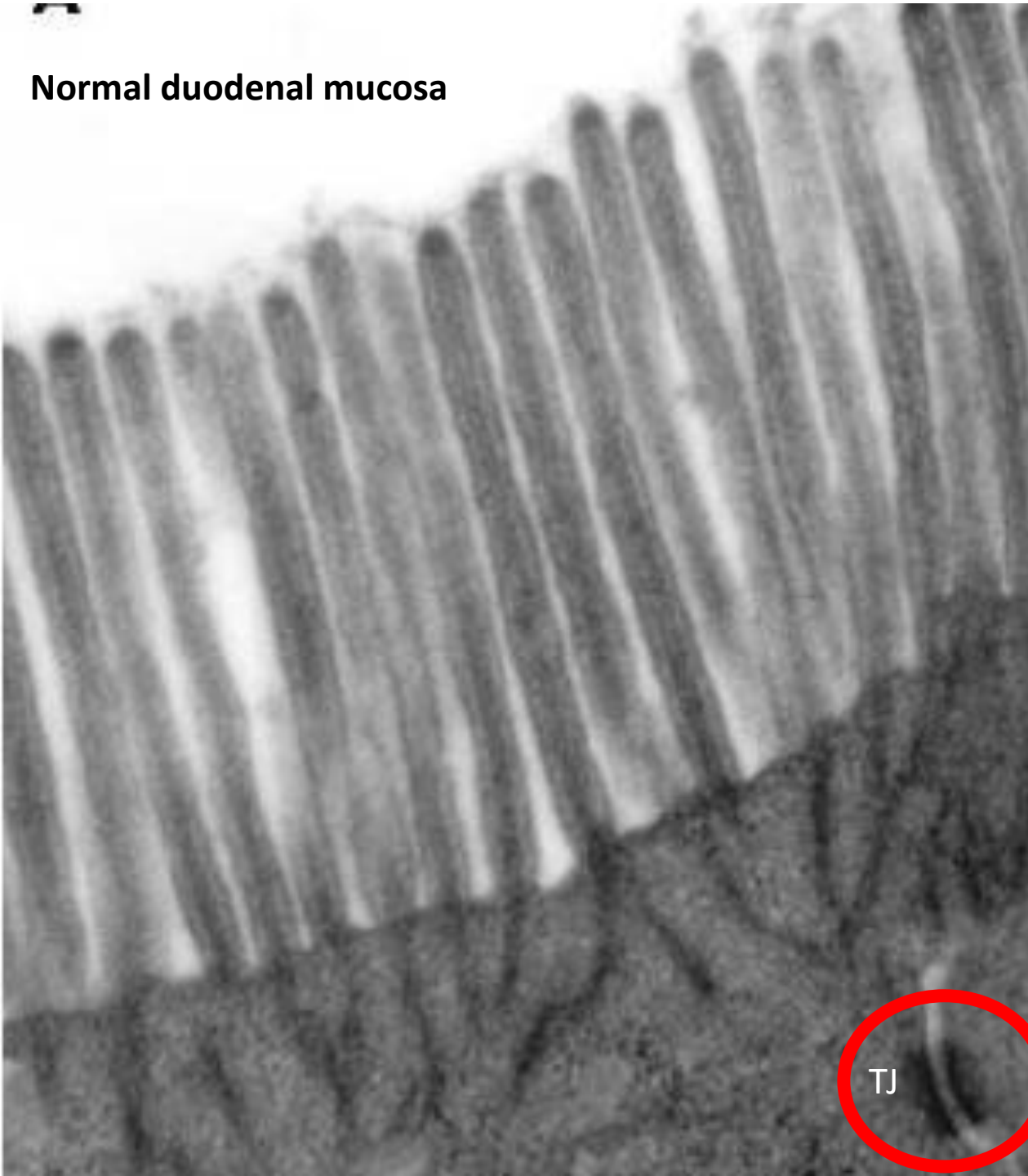
PROPORTION OF UNIQUE GENES IN THE HUMAN BODY



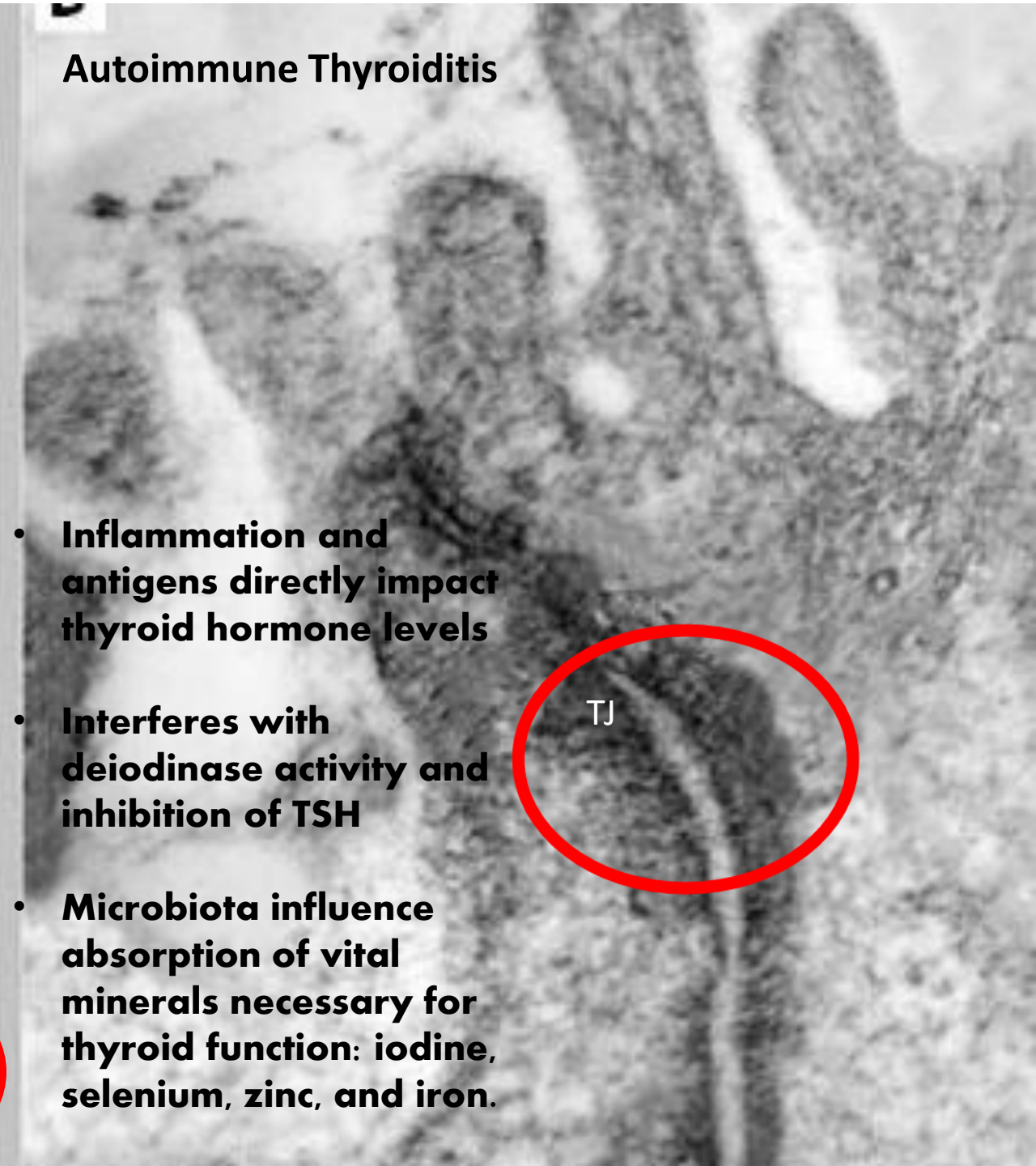
Ninety-nine percent of the unique genes in your body are bacterial. Only about one percent is human.



Normal duodenal mucosa



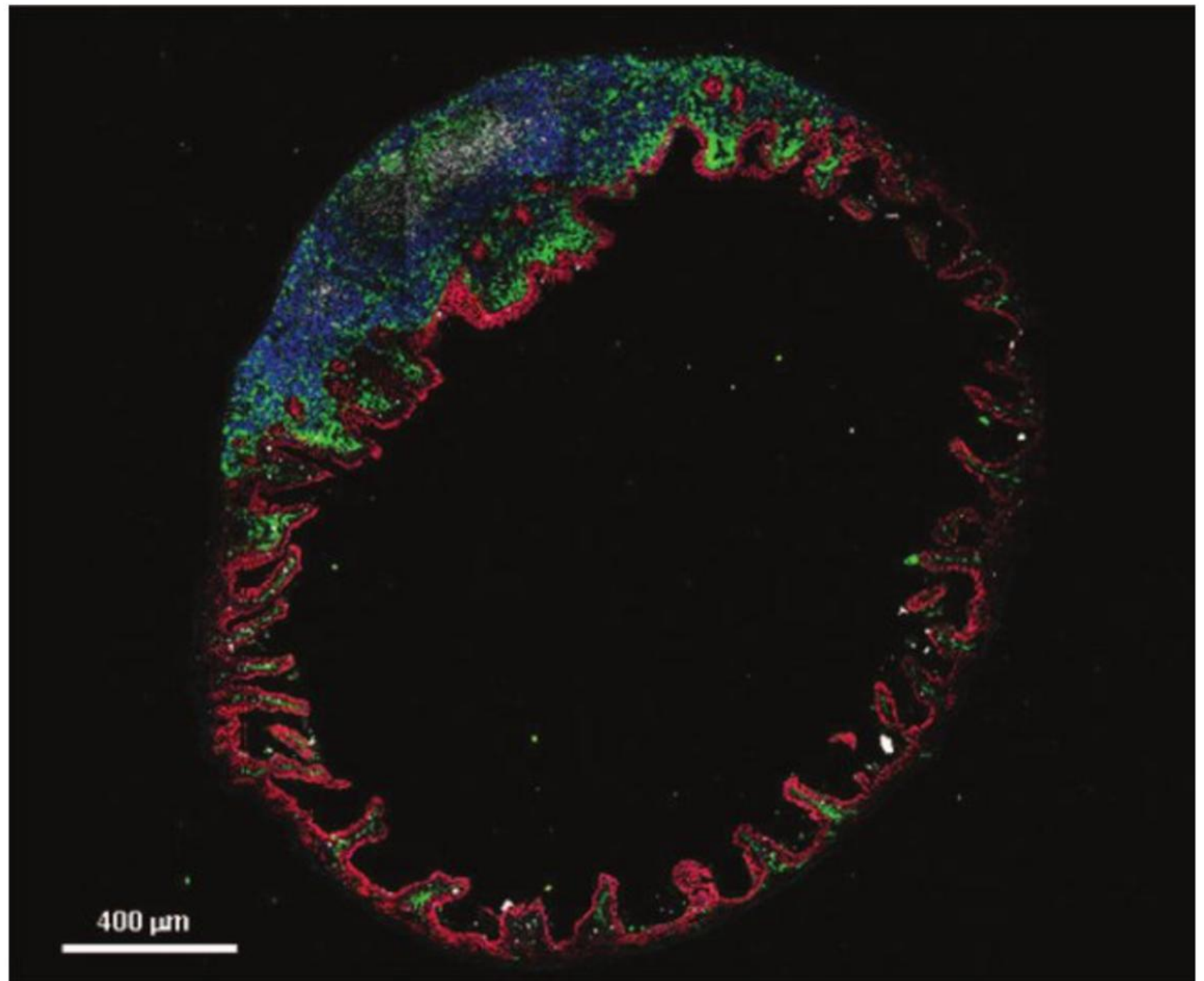
Autoimmune Thyroiditis



- **Inflammation and antigens directly impact thyroid hormone levels**
- **Interferes with deiodinase activity and inhibition of TSH**
- **Microbiota influence absorption of vital minerals necessary for thyroid function: iodine, selenium, zinc, and iron.**

Functional Interactions Between Enterocytes, Immune Cells, and Microbiota

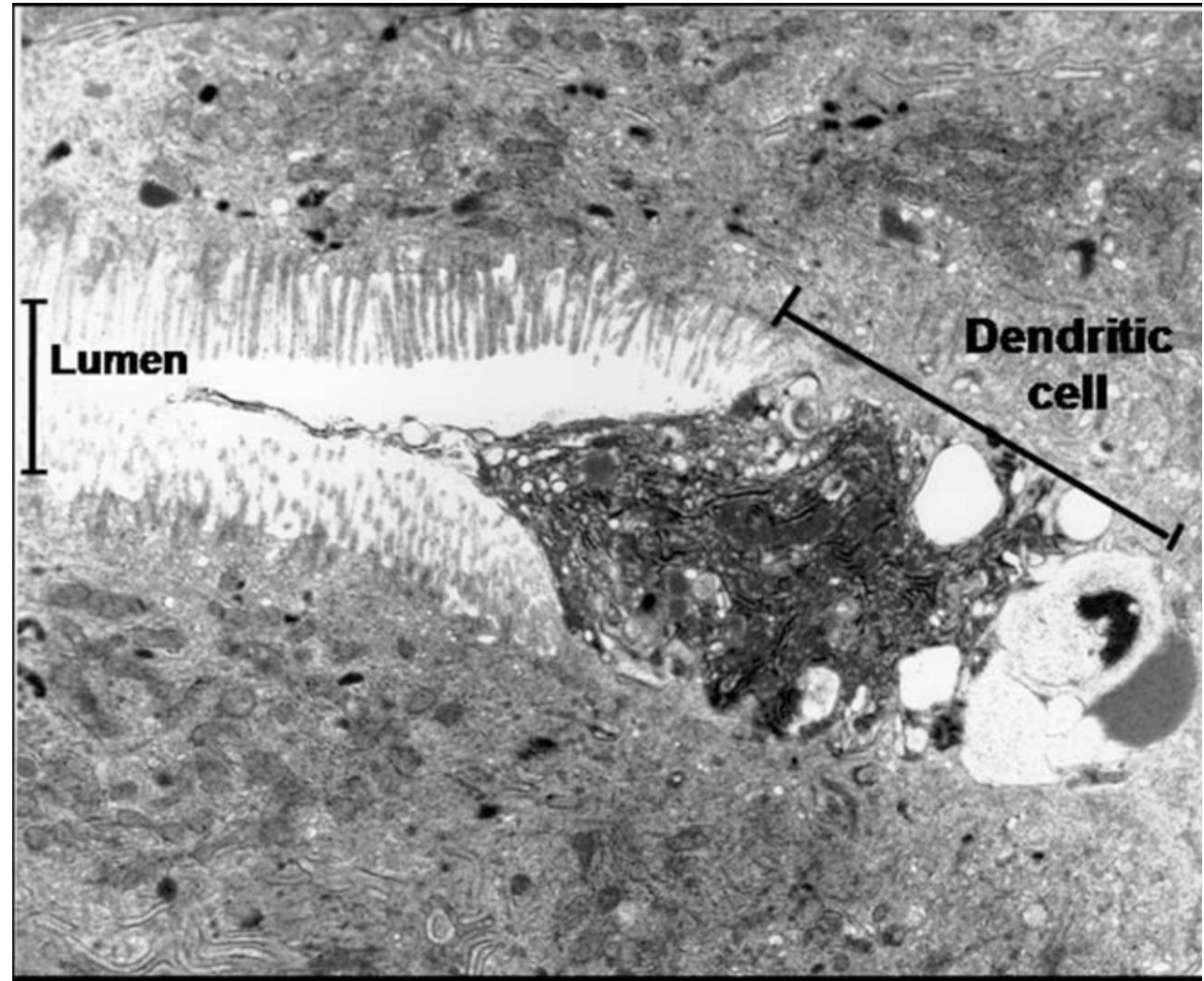
- RED- Gut Epithelial Cells
- GREEN- Dendritic Cells
- BLUE- Beta Cells
- WHITE- T-Cells



Immune Dendritic Cell inserted
in the gut epithelial layer and
into intestinal lumen.

Dendritic cells are **central
to the initiation of
primary immune
responses** and are pivotal
in the generation of
adaptive immunity

Inflammatory bowel diseases 2010
Intestinal dendritic cells: Their role in bacterial
recognition, lymphocyte homing, and intestinal
inflammation



Our ancestral human diet

Should it be a paradigm for contemporary nutrition?

- **Modern man emerged over 200,000 years ago**
- **Human genome has remained unchanged**
- **Genetically we are adapted to the foods present 200,000 years ago.**
- **Fruits and vegetables, provided greater than 50% of energy intake, Americans today consume less than 16%.**
- **High plant-based dietary intake made ancestral diets base-yielding, unlike today's acid-producing pattern.**
- **Fiber consumption was estimated to be 100-150 g/day and the average American today consumes less than 10 g/day**

S Boyd Eaton¹

Proc Nutr Soc. 2006
Feb;65(1):1-6. doi:
10.1079/pns2005471

The plant-based diet microbiome

- **More short chain fatty acids than meat eaters**
Protect the intestinal barrier, regulating our immune system and control our appetite and blood sugar
- **Better at suppressing the growth of colon cancer cells**
Butyrate triggers apoptosis of pre-cancerous cells
- **Far lower levels of secondary bile acids**
Secondary bile acids are pro-inflammatory & pro-carcinogenic to our gut lining
- **The plant-based microbiomes lacked the ability to metabolize carnitine (from meat) and choline (from eggs)**
Individuals with elevated serum TMAO are 3.4 times more likely to develop CRC

Angelis M, et al. Diet influences the functions of the human intestinal microbiome. 2020

Bae S, et al. Plasma choline metabolites and colorectal cancer risk in the Women's Health Initiative Observational Study. *Cancer Res.*

EAT PLANTS

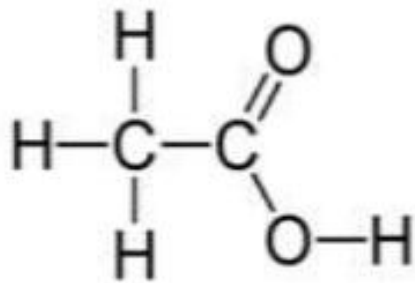


Commensal
Bacteria

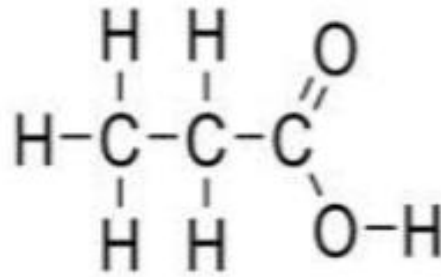
Short
Chain
Fatty
Acids

Short Chain Fatty Acids

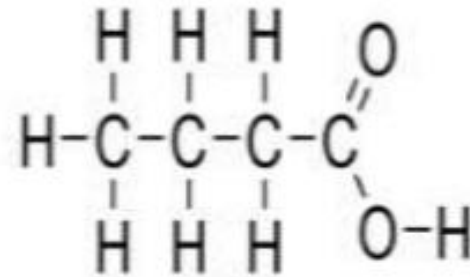
- Beneficial microbiota find fiber from whole plant foods, ferment it, and produce by-products called **short-chain fatty acids**.
- SCFAs have numerous beneficial functions and travel and communicate with different systems in our bodies.
- 90% of SCFAs are metabolized by the microbiota for energy or absorbed by intestinal cells
- A smaller % is circulated through peripheral circulation to other tissues
- SCFA's serve as 10% of daily caloric requirements for humans



Acetic acid (acetate)



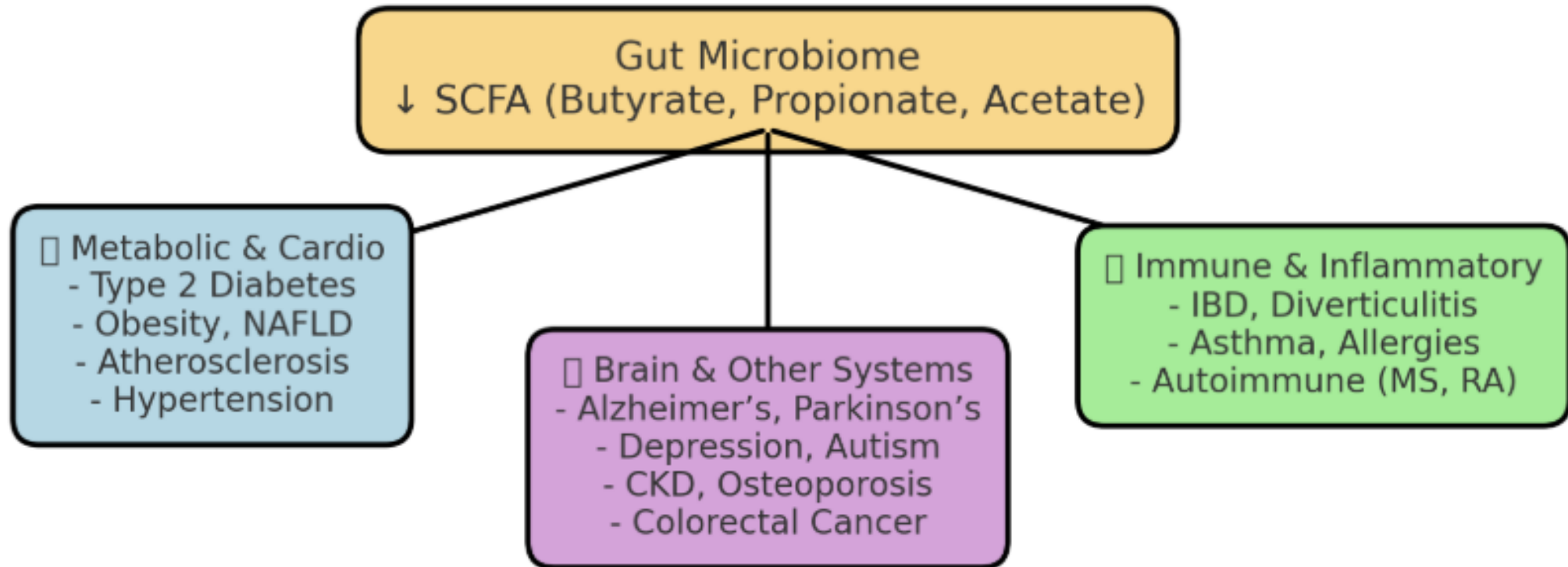
Propionic acid (propionate)



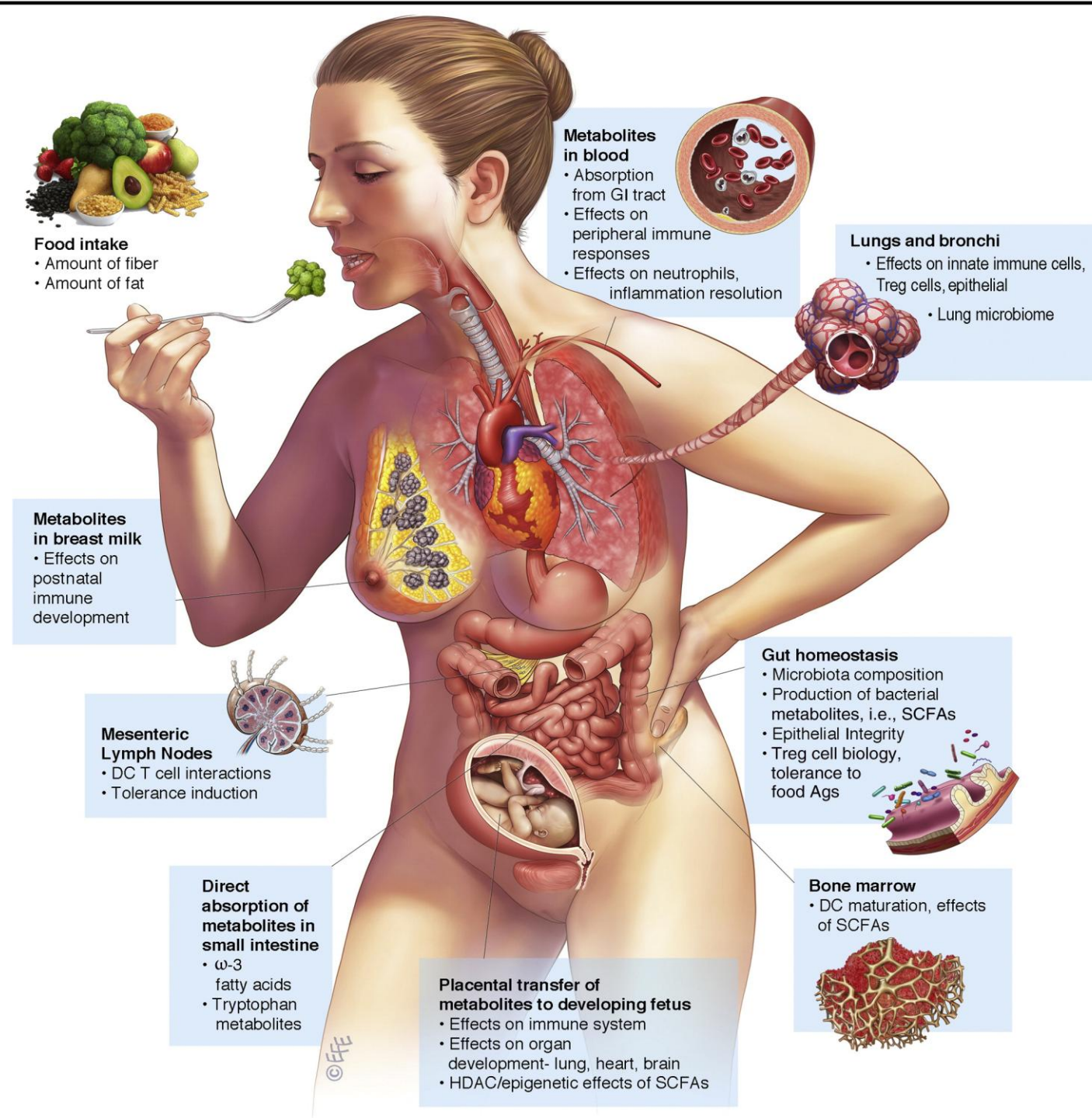
Butyric acid (butyrate)

Immune Dysregulation

Low Fiber → Low SCFAs → Chronic Diseases



Systemic Effects of SCFA



The Impact of Dietary Fiber on Gut Microbiota in Host Health and Disease

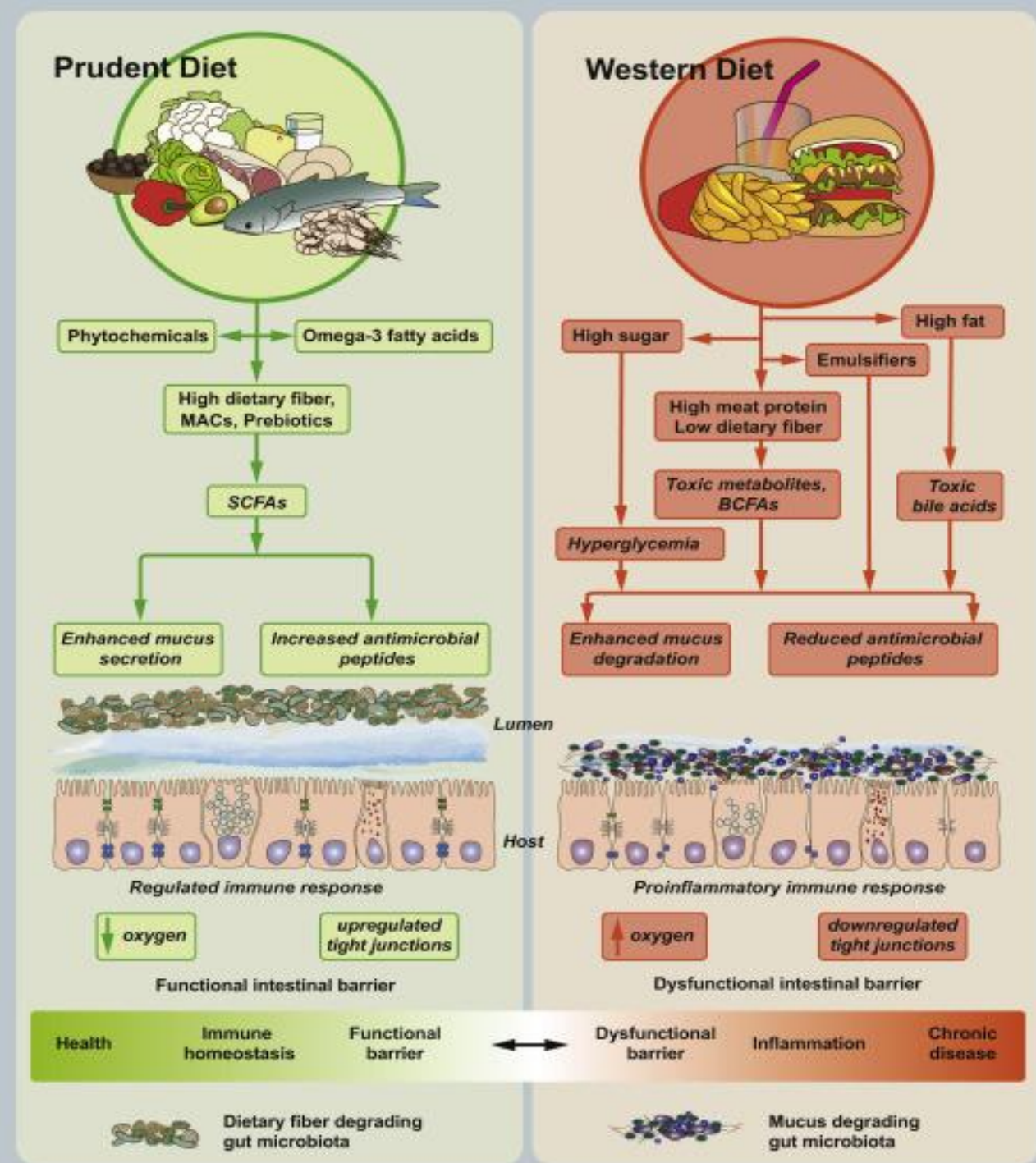
Type, quality, and origin of our food shape our gut microbes and affect their composition and function, impacting host-microbe interactions.

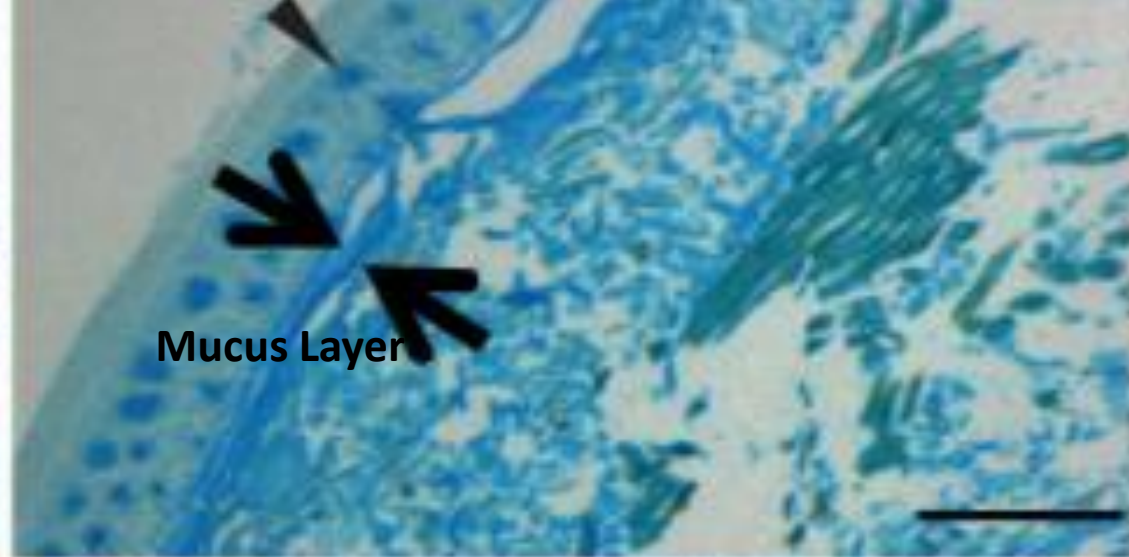
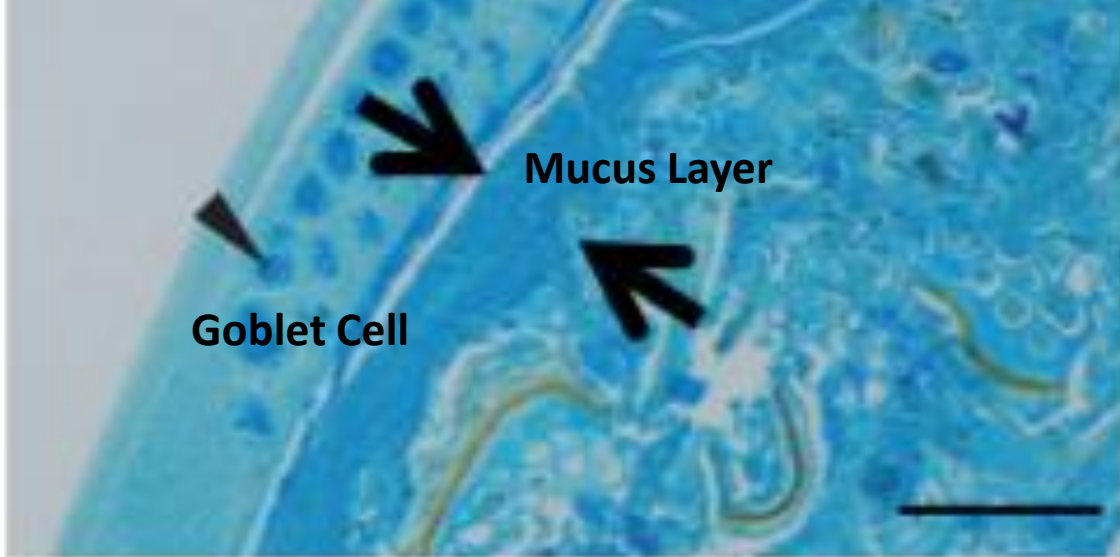
- Enhance mucous and anti-microbial function
- Increase tight junction proteins
- SCFA reduce oxygen levels
- SCFA maintain functional immune system

Alterations in this ecosystem lead to Increased susceptibility to

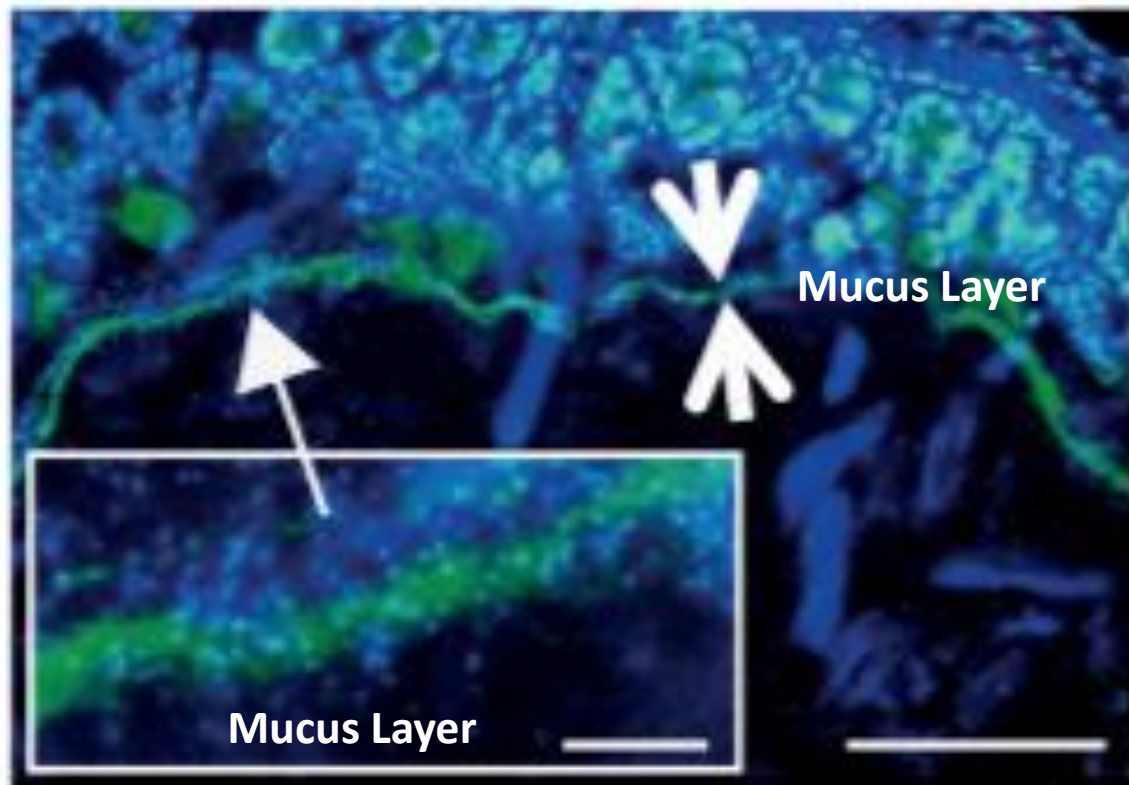
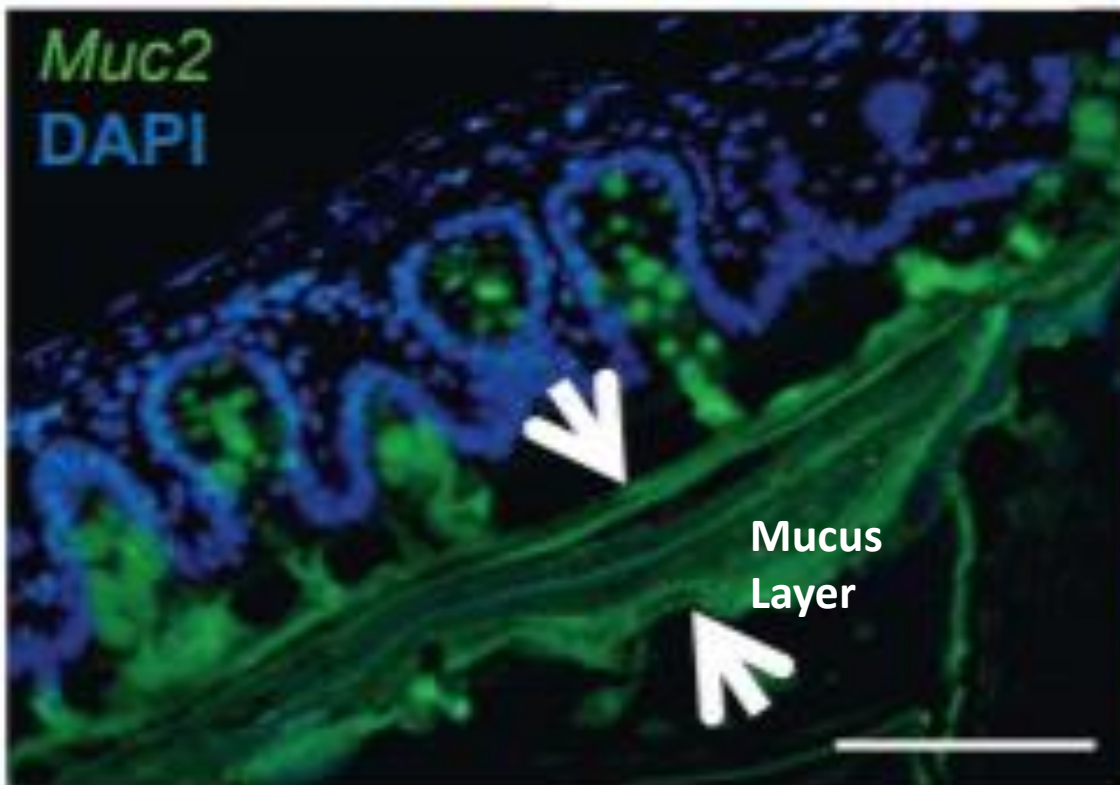
- Infection
- IBD
- CRC

Cell Host & Microbe 23, June 13, 2018





B



Brain-Gut-Microbiome (BGM) bidirectional communication system:

- Neuroendocrine
- Neuronal
- Immune

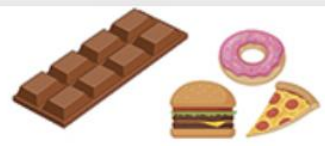
Diet

- Modulates the microbiome
- Modulates structure and function of the brain through these communication channels

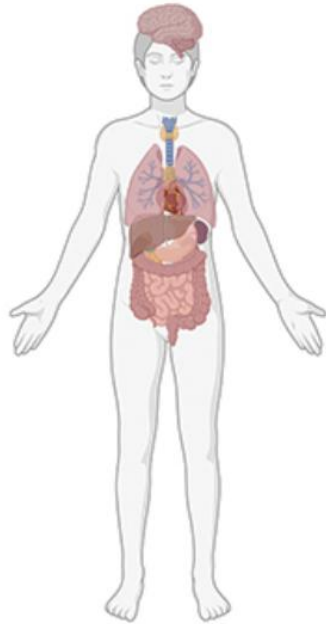
Preclinical and Clinical Studies focusing on dietary habits of psychiatric and neurologic disorders

- | | |
|-------------------------------|-------------------|
| • Depression | -Anxiety |
| • Cognitive decline, dementia | -Eating disorders |
| • Parkinson’s Disease | -ADHD |
| • Autism Spectrum Disorder | |
| • Epilepsy | |

Clinical studies have demonstrated that the diet induced anti-inflammatory effects mediated by microbial metabolites from dietary fiber and polyphenols have an impact on brain health, structure, and function.



Imbalanced Diet (High processed and ultra sugar products)



**Low immunity,
Mental disorders**

Neuroinflammation



**Strong immunity,
Improved mental health**

**Regulation of
Neurotransmitters**



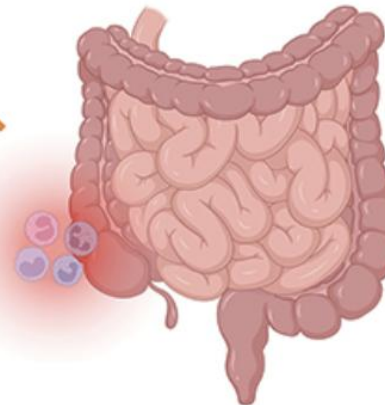
Balanced Diet



**Gut-Brain
Interaction**

↑ **TMAO,
LPS**

**Gut
Inflammation**

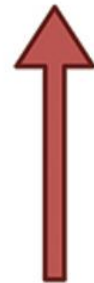


**Immune
Homeostasis,
Intestinal epithelial
integrity**

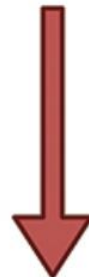
IL-10 ↑
IP-10, IL-17, IL-12, TNF, LPS ↓

Gut Microbiota (Altered)

***Klebsiella,*
Escherichia,
Shigella,
Enterobacteriace,
Fermicutes,
*Ruminococcus***



***Prevotella,*
Lactobacillus,
Enterococcus,
Bifidobacteria,
*Bacteroidetes***

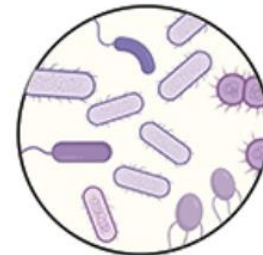


Gut Microbiota (Healthy)

***Klebsiella,*
Escherichia,
Shigella,
Enterobacteriace,
Fermicutes,
*Ruminococcus***

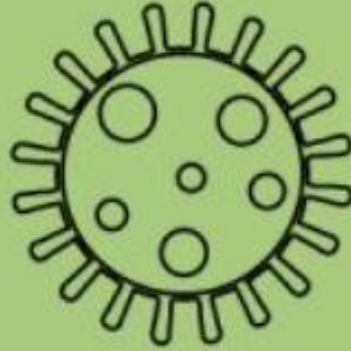


***Prevotella,*
Lactobacillus,
Enterococcus,
Bifidobacteria,
*Bacteroidetes***





**Increase microbiome diversity
and abundance by consuming
greater than
30 different plants per week**



prebiotics

Fibers that feed
good bacteria

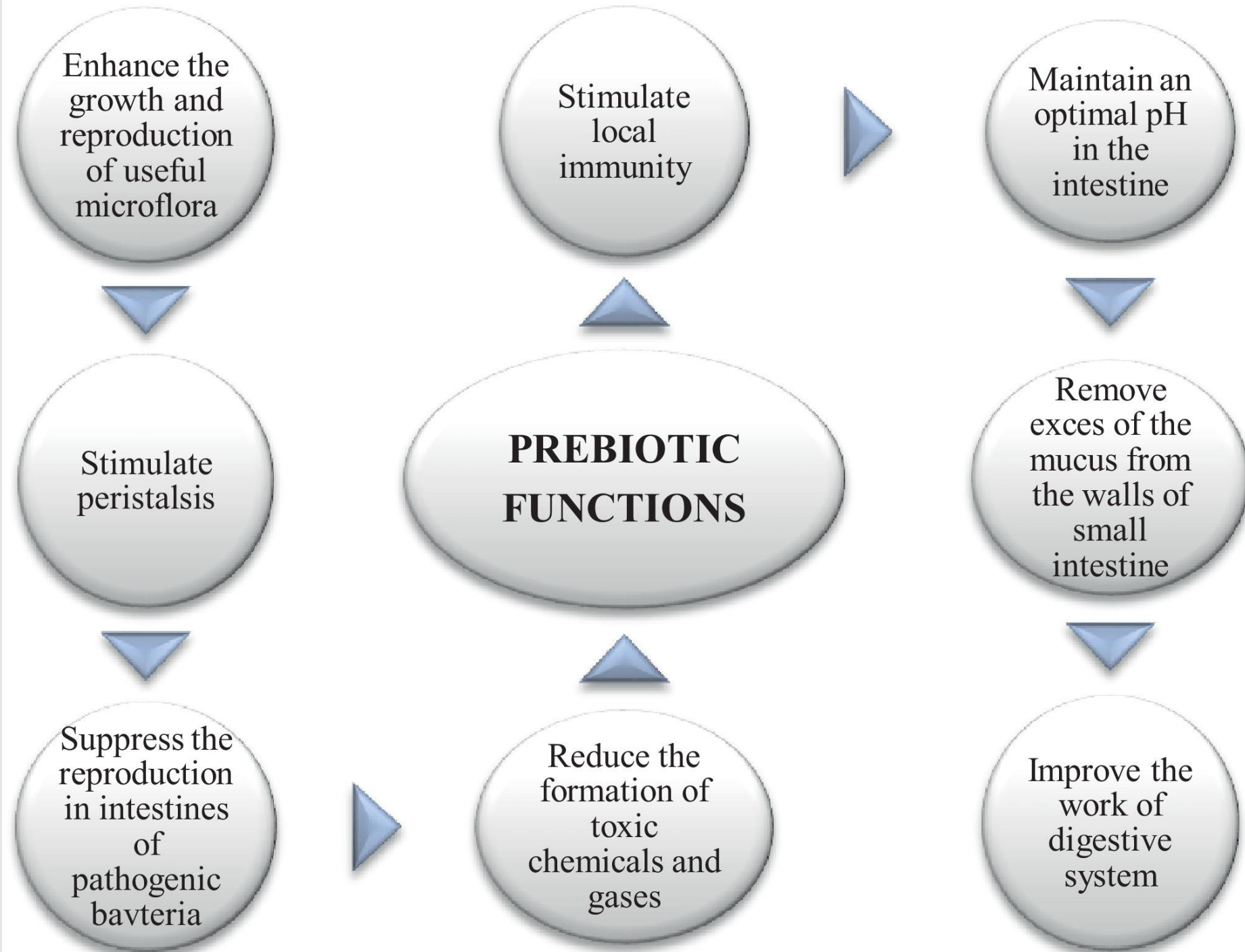
probiotics

Live beneficial bacteria
in your gut

postbiotics

Metabolites produced
by good bacteria

Functions of Prebiotics



Probiotics

Fact Sheet for Health Professionals

<https://ods.od.nih.gov/factsheets/Probiotics-HealthProfessional/>

There are currently no formal recommendations for or against the use of probiotics in healthy people. However, some expert bodies of health professionals provide guidance on the use of specific probiotic strains in people with certain health conditions. These groups also offer guidance for clinicians and consumers on choosing probiotic products.

[U.S. Department of Health & Human Services](#)

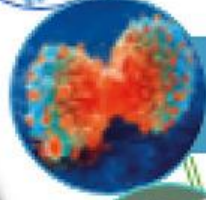
[National Institutes of Health](#)

[Division of Program Coordination, Planning, and Strategic Initiatives](#)

Postbiotics



Immuno-modulation



Anti-tumor/Anti-proliferative



Pathogen inhibition and infection prevention



Anti-atherosclerotic



Autophagy

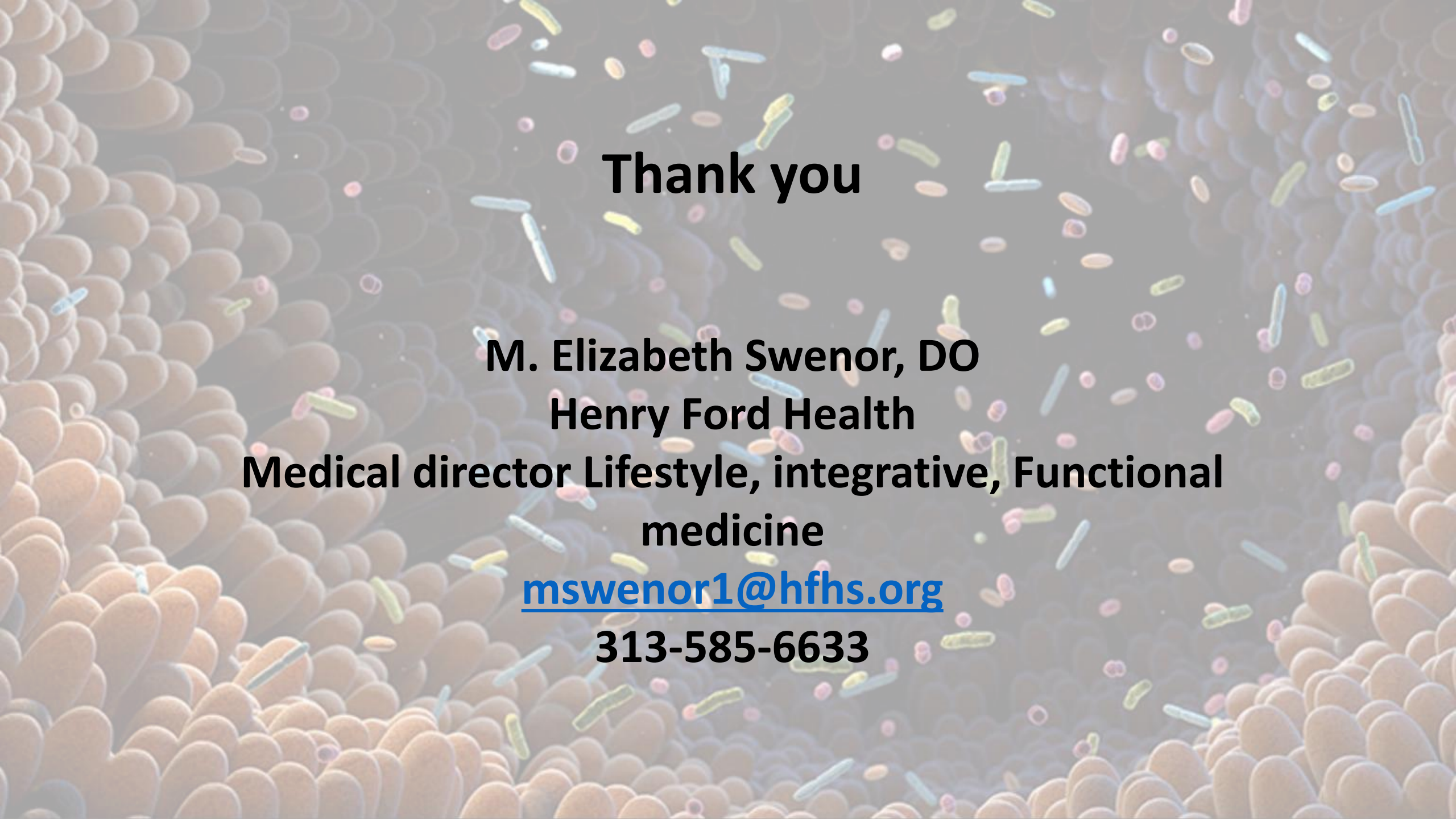


Accelerated wound healing



Metabolic homeostasis



The background of the slide is a microscopic image showing the surface of the human gut. It features numerous brown, rounded villi (finger-like projections) that are densely packed. Scattered throughout the scene are various colorful bacteria, appearing as small, elongated or oval shapes in shades of blue, green, yellow, and pink. The overall lighting is soft, highlighting the texture of the villi and the presence of the microbial flora.

Thank you

**M. Elizabeth Swenor, DO
Henry Ford Health
Medical director Lifestyle, integrative, Functional
medicine**

mswenor1@hfhs.org

313-585-6633