

Congresso Nazionale SINPE

**CLINICAL NUTRITION:
SHAPING A BETTER FUTURE
OF HEALTH CARE**



Padova Congress
Via Goldoni 8, Cancelli C - Padova

AI per la personalizzazione della terapia nutrizionale: dagli algoritmi predittivi alla nutrizione del futuro

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27 Novembre 2025

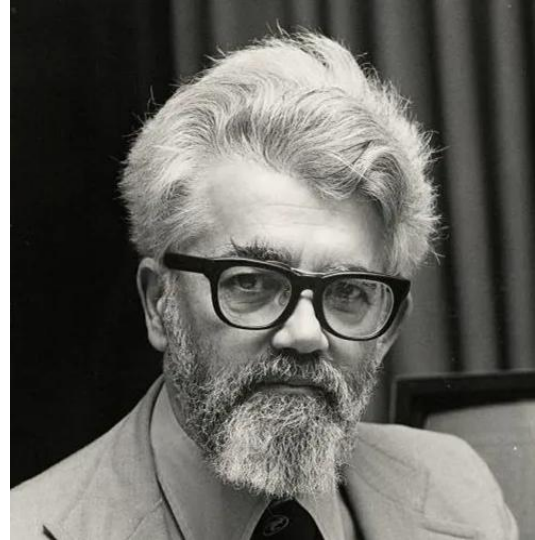
1950

The book “*Computing machinery and intelligence*” by Alan Turing was published.



1956

John McCarthy described the term *Artificial intelligence* as “the science and engineering of making intelligent machines”.



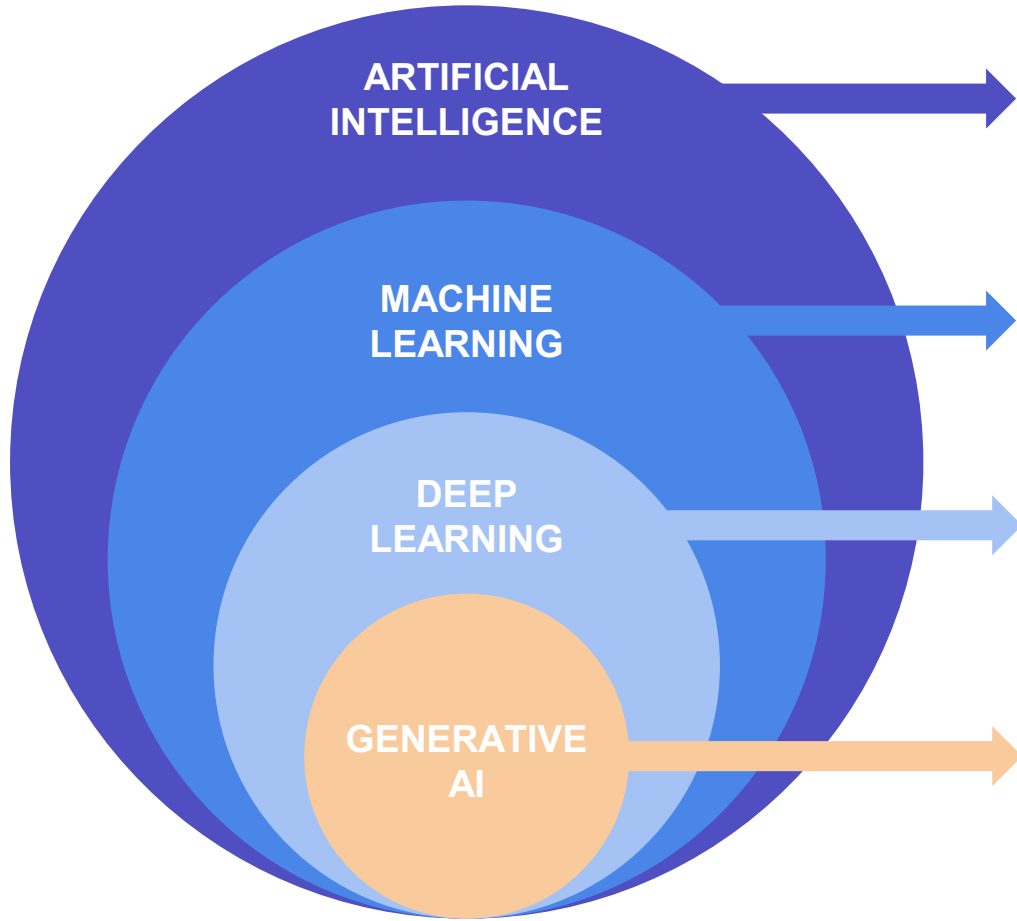


ARTIFICIAL INTELLIGENCE

ORDER
FOOD
ONLINE

Can I Help?





Artificial Intelligence (AI) refers to the ability of computers to emulate human thought and perform tasks in a real-world environment.

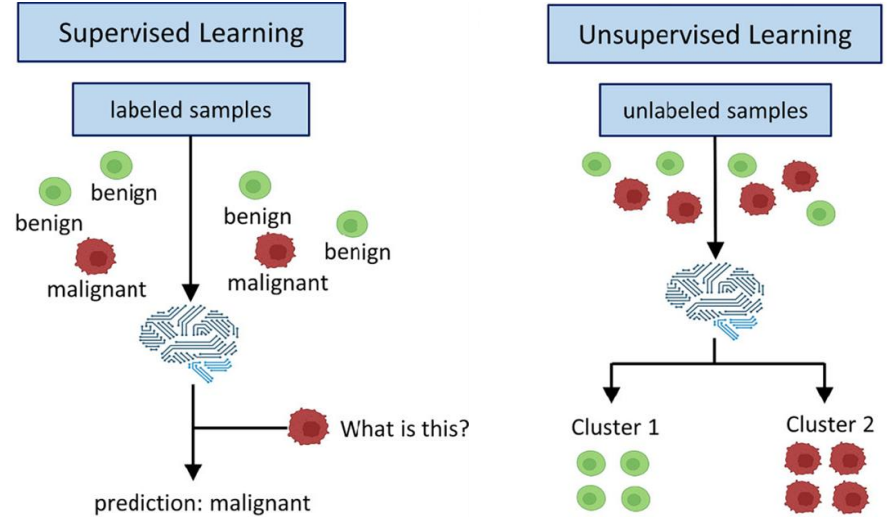
Machine Learning (ML) trains computers to learn from data and improve with experience without being explicitly programmed to do so.

Deep Learning (DL) uses artificial neural networks inspired by the human brain.

Generative AI (GenAI) enables computers to create new content by learning patterns from data.

Learning approaches

Learning	Supervised	Unsupervised
Dataset	labelled	unlabelled
Aim	Predict outcome	Discover hidden patterns



Eckardt, Jan-Niklas, et al.
Frontiers in oncology 12 (2022): 960984.

Hi ChatGPT! What learning approach do you use?

Hi!

I learn in two main steps:

1. I read a lot and learn patterns

I'm trained on huge amounts of text and learn to predict what words should come next.

This is called **self-supervised learning**.

2. Humans teach me how to answer nicely

People review my answers, choose the better ones, and I learn from those choices.

This is called **reinforcement learning from human feedback**.

So: I learn from **patterns in text + feedback from humans**.

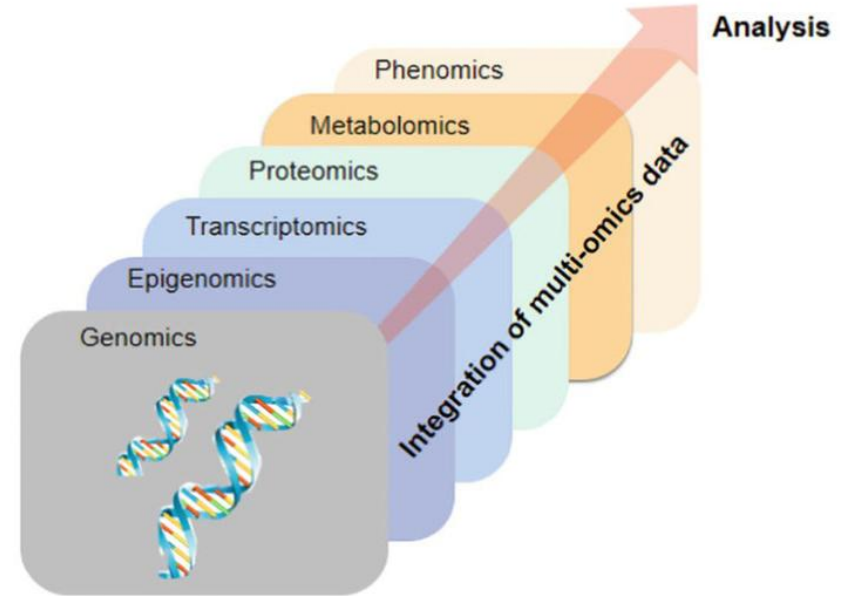
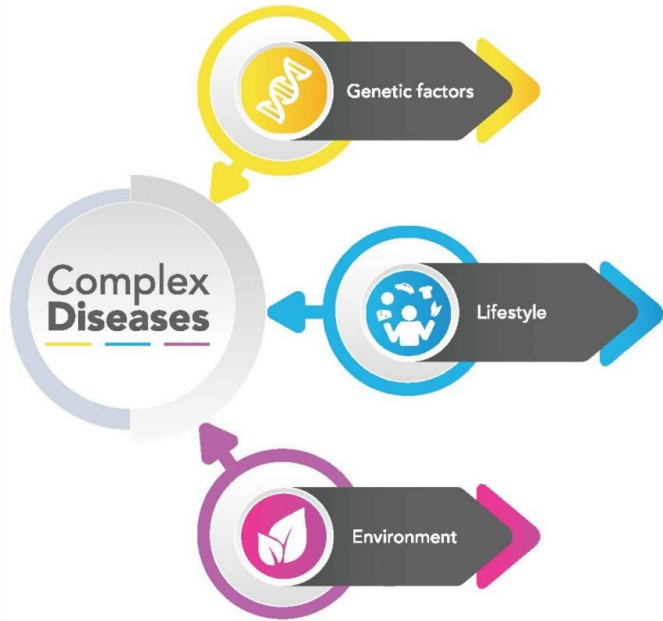


Table 1 | A non-exhaustive list of current and potential AI applications in medicine

Basic biomedical research	Translational research	Clinical practice
Automated experiments	Biomarker discovery	Disease diagnosis
Automated data collection	Drug-target prioritization	Interpretation of patient genomes
Gene function annotation	Drug discovery	Treatment selection
Prediction of transcription factor binding sites	Drug repurposing	Automated surgery
Simulation of molecular dynamics	Prediction of chemical toxicity	Patient monitoring
Literature mining	Genetic variant annotation	Patient risk stratification for primary prevention

Yu, K. H. et al.,
Nat Biomed Eng, 2(10), 719–731 (2018)

A multi-omics approach for complex diseases



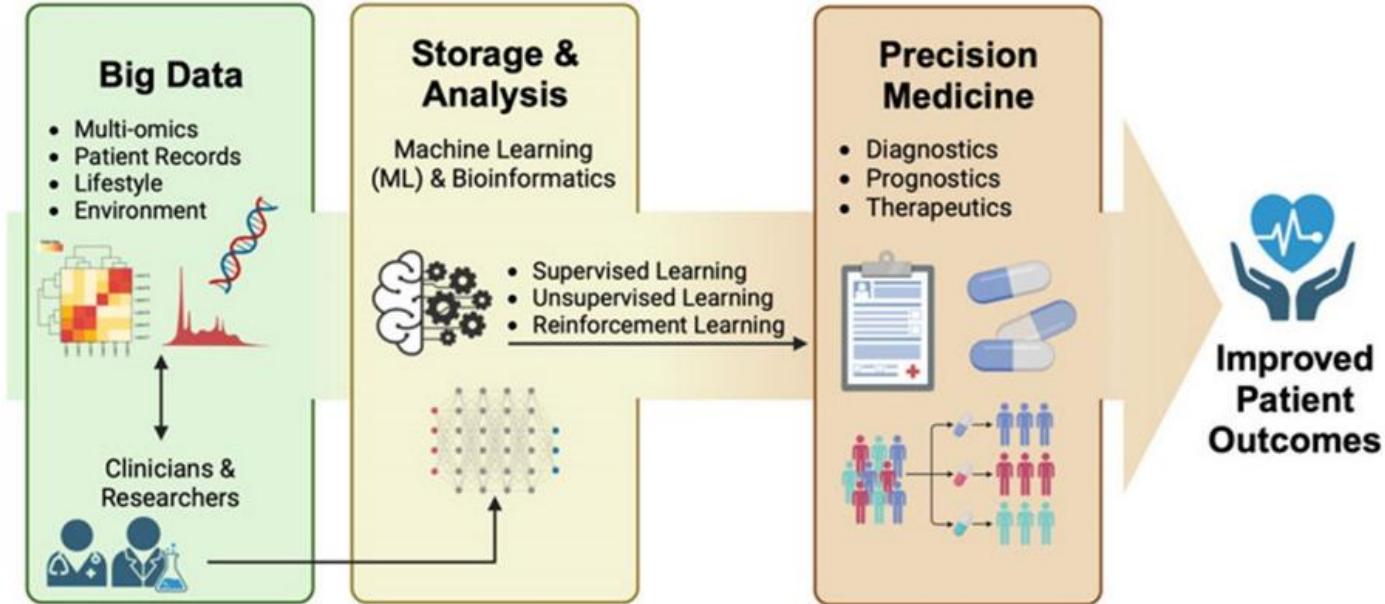
e.g. Alzheimer, diabetes, cancer, autism,
arthritis, multiple sclerosis, heart diseases, ...



Environmental factors, lifestyle and **diet** contribute to modulating the different layers of biological regulation, from the epigenetic landscape and gene expression to protein and metabolite profiles.

Babu, M. et al.
Molecular & Cellular Proteomics,
22, Issue 6, 100561 (2021)

AI/ML can bridge the gap



Wu, Jingyue et al.,
Frontiers in molecular biosciences,
vol. 10 1337373 (2024)

[("artificial intelligence" OR "machine learning" OR "deep learning") AND ("diet" OR "nutrition" OR "food" OR "dietary assessment" OR "eating")]

> [Nutrients](#). 2024 Apr 6;16(7):1073. doi: 10.3390/nu16071073.

Applications of Artificial Intelligence, Machine Learning, and Deep Learning in Nutrition: A Systematic Review

Tagne Poupi Theodore Armand ¹, Kintoh Allen Nfor ², Jung-In Kim ¹, Hee-Cheol Kim ^{1 2 3}

Affiliations + expand

PMID: 38613106 PMCID: [PMC11013624](#) DOI: [10.3390/nu16071073](#)



Table 3. Clusters of the identified studies.

Clusters	References	Records	Records (%)
Smart and personalized nutrition	[22–31]	10	32.3
Dietary assessment	[32–37]	6	19.4
Food recognition and tracking	[38–41]	4	12.9
Predictive modeling for disease	[42–49]	8	25.8
Disease diagnosis and monitoring	[50–53]	3	9.7

AI nutrition recommendation using a deep generative model and ChatGPT

Ilias Papastratis, Dimitrios Konstantinidis, Petros Daras & Kosmas Dimitropoulos 

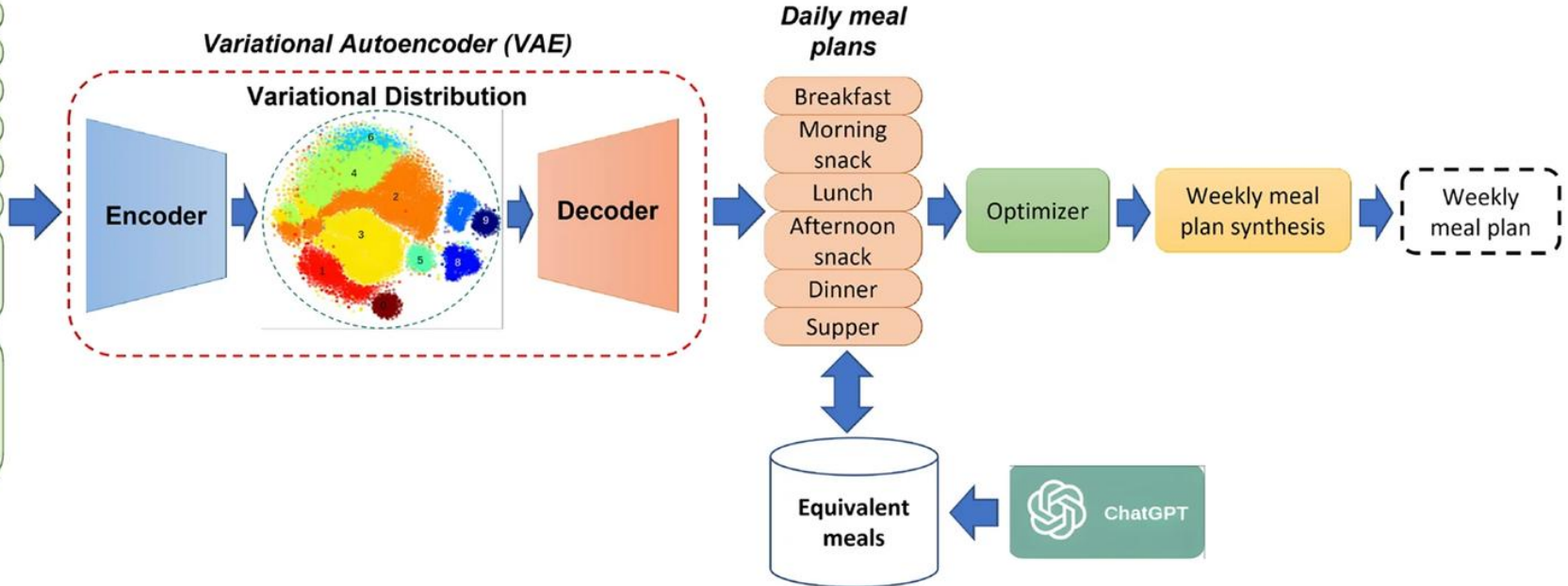
Scientific Reports **14**, Article number: 14620 (2024) | [Cite this article](#)

72k Accesses | 63 Citations | 388 Altmetric | [Metrics](#)



User profile

- Weight
- Height
- BMR
- Age
- BMI
- PAL
- Target energy intake
- Other conditions (i.e., CVD, T2D, iron deficiency)



Article [Open access](#) | Published: 18 January 2025

Predicting metabolite response to dietary intervention using deep learning

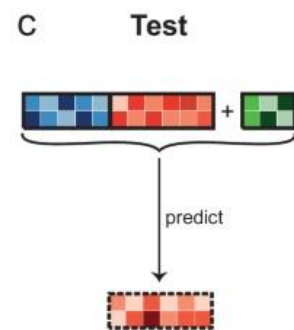
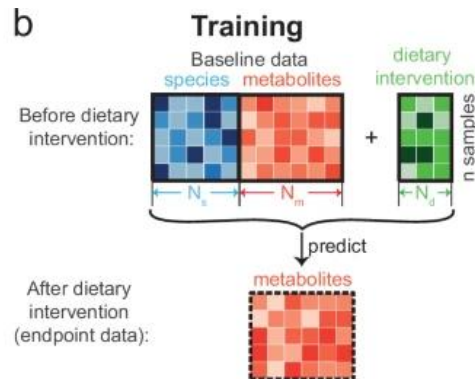
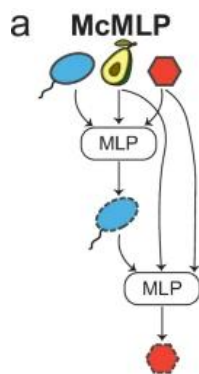
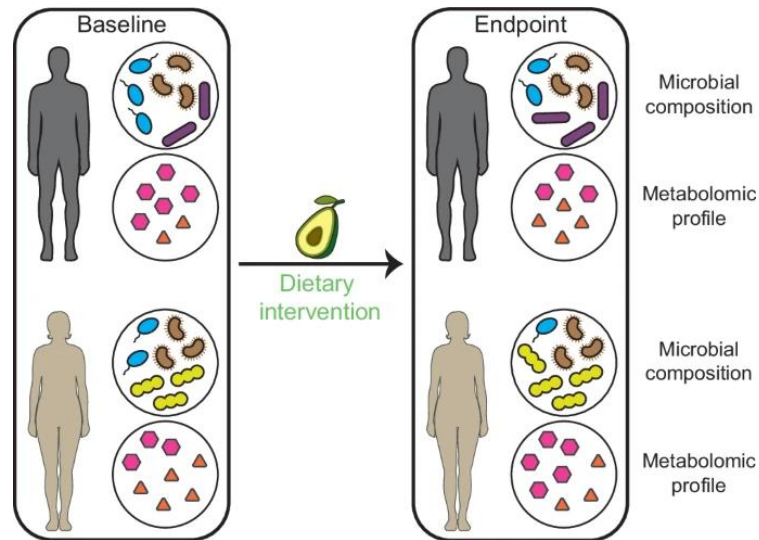
[Tong Wang](#), [Hannah D. Holscher](#), [Sergei Maslov](#), [Frank B. Hu](#), [Scott T. Weiss](#) & [Yang-Yu Liu](#) [✉](#)

[Nature Communications](#) **16**, Article number: 815 (2025) | [Cite this article](#)

10k Accesses | 12 Citations | 4 Altmetric | [Metrics](#)



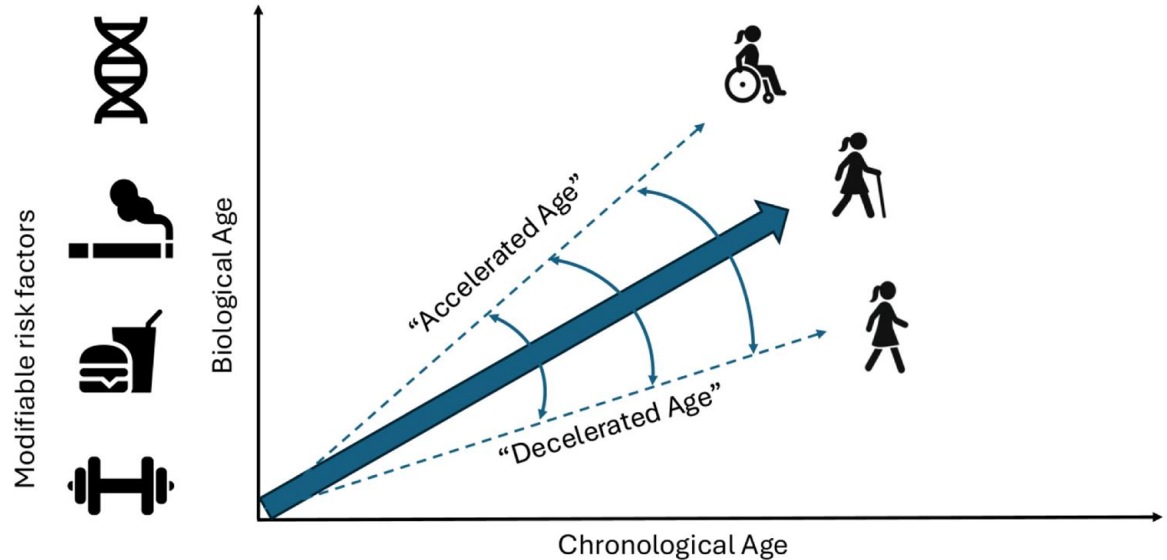
DL-based model predicts endpoint metabolite concentrations based on baseline microbial compositions



Biological aging clocks

Biological aging clocks: computational models that estimate biological age.

- *Omics-based:*
 - epigenetics-based
 - proteomics-based
 - metabolomics-based
- *Clinical-based:*
 - blood-based
- *Imaging-based:*
 - MRI-based



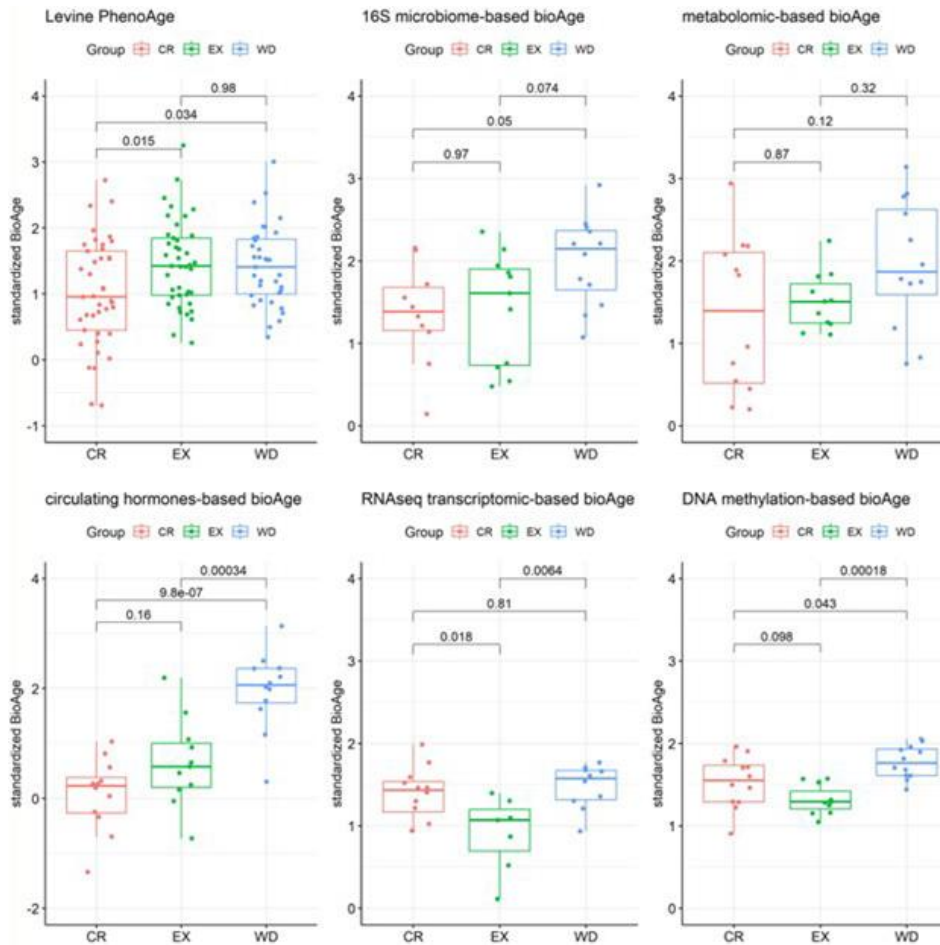
Multi-omic analysis of biological aging biomarkers in long-term calorie restriction and endurance exercise practitioners: A cross-sectional study

Giovanni Fiorito, Valeria Tosti, Silvia Polidoro, Beatrice Bertozzi, Nicola Veronese, Edda Cava, Francesco Spelta, Laura Piccio, Dayna S. Early, Daniel Raftery, Paolo Vineis, Luigi Fontana

First published: 18 December 2024 | <https://doi.org/10.1111/accel.14442> | Citations: 2




multi-omic **BioAge** biomarkers were **lower in calorie restriction (CR)** practitioners and endurance athletes (EX) than controls consuming Western diets (WD)



What about nutrition-based clocks?

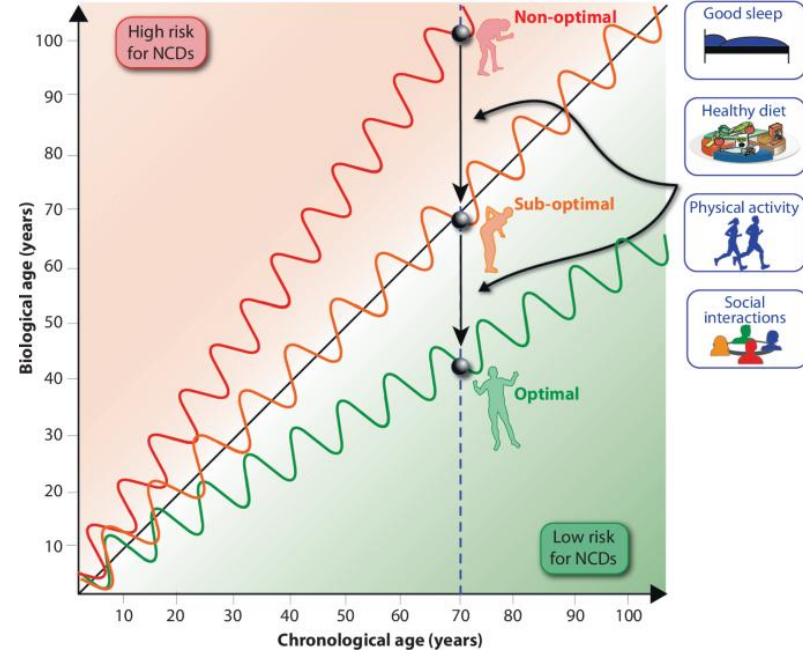
Perspective | [Open access](#) | Published: 20 August 2025

Modulating biological aging with food-derived signals: a systems and precision nutrition perspective

[Carsten Carlberg](#) , [Andreas Blüthner](#), [Irina Schoeman-Giziakis](#), [Annemarie Oosting](#) & [Luca Cocolin](#) 

npj Aging **11**, Article number: 76 (2025) | [Cite this article](#)

5625 Accesses | 37 Altmetric | [Metrics](#)



but still largely unexplored...

Concluding remarks

- Artificial Intelligence plays a **key role** in both integrating and analyzing multi-omics and clinical data for the study of **complex conditions**;
- In the nutritional field, AI is emerging as a **tool for the personalization of nutritional therapy** but is not yet well established in nutritional practices;
- **Biological aging clocks** show that diet can influence our biological age, but “nutrition-informed” clocks are still a frontier and a **promising field for future research**.

Acknowledgements



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Thank you for
your attention

