

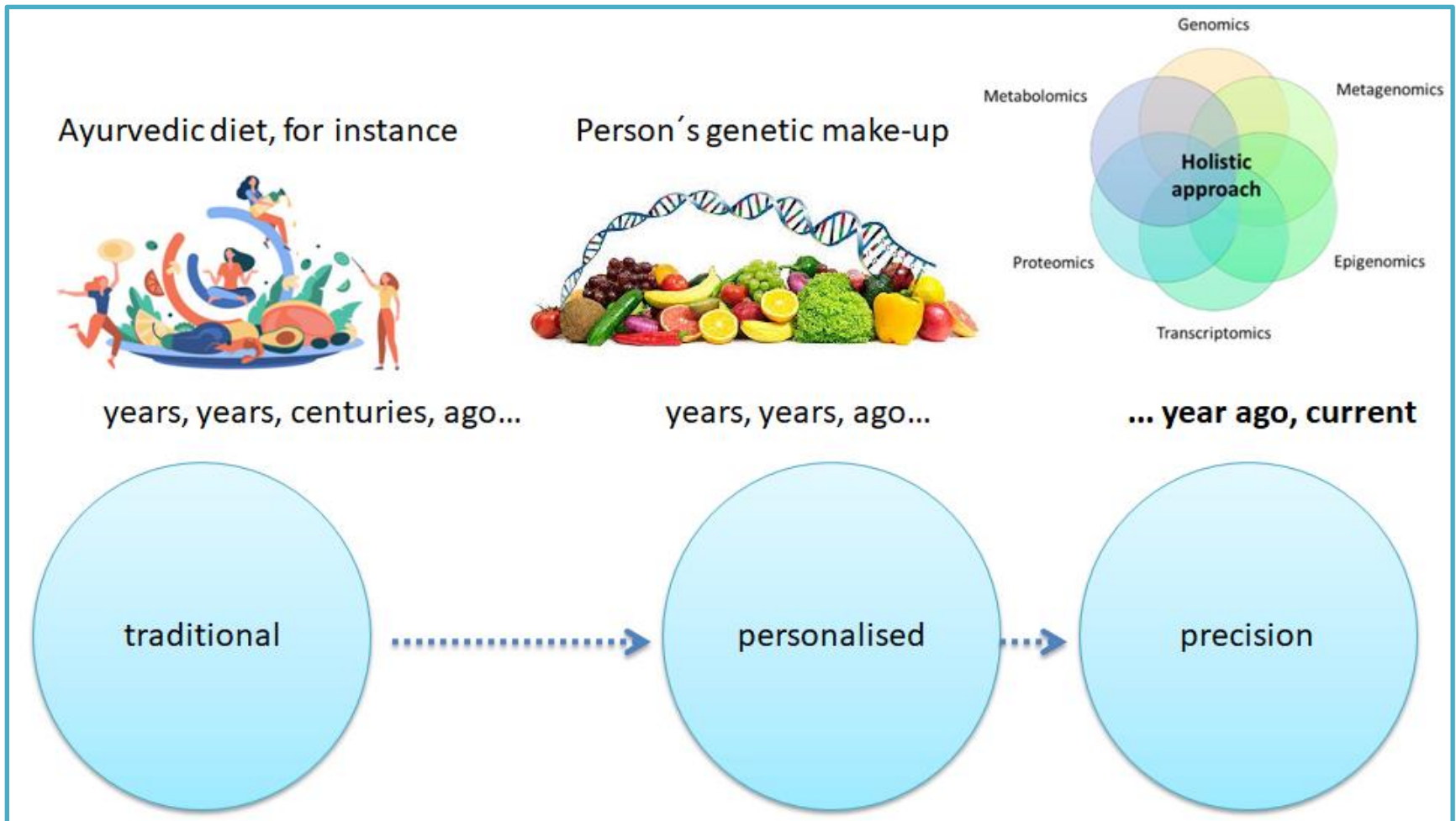
Use of Artificial Intelligence in Personalized Precision Nutrition and Data Protection

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Important titles

- Nutrition: traditional, personalised, precision
- Governance: Ethics, and laws

Nutrition: traditional, personalised, precision



[1. Ayurvedic Diet Guide: The Complete Guide to the Ayurvedic Diet - Auric \(theauric.com\)](#)

[2. The Lowdown on Personalised Nutrition | Ideal Nutrition](#)

[3. Nutrients | Free Full-Text | Holistic Integration of Omics Tools for Precision Nutrition in Health and Disease \(mdpi.com\)](#)

Nutrition: traditional to {computer}

Ayurvedic diet prescriptions ~3000 years ago in India

OLDEST HISTORY

Ayurveda Diet For Healthy Life

ether
air
fire
water
earth

Dosha Diet - Vata, Pitta, Kapha

Vata Pitta Kapha

Ayurvedic diet incorporates nearly all the natural ingredients that have the positive influence throughout the body.

HISTORY ~ 1960

Menu planning with a computer

Fig. 1

Linear programming method: has an objective function and constraints and a feasible solution need to be obtained

HISTORY ~ 1990 - 2000

Expert system: AI system that attempts to model the processes of an human expert

Query
Advice

Expert System
User Interface
Inference Engine
Knowledge Base

Methods for inference were majorly:

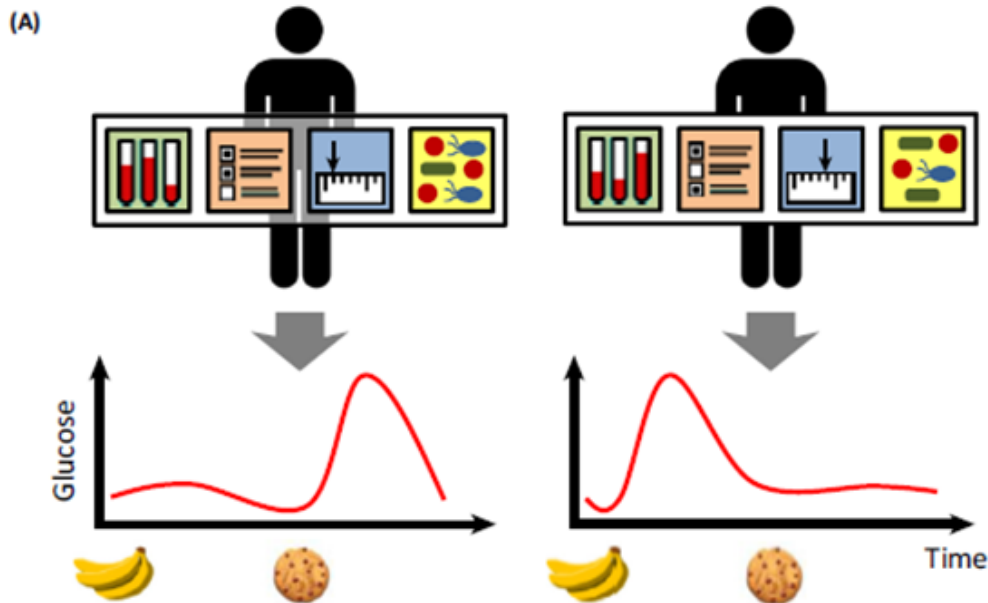
1. Cases based reasoning
2. Rule based reasoning

Novelty: Incorporation of expert knowledge

Nutrition: traditional to personalised... Why?

SCIENCE (1)

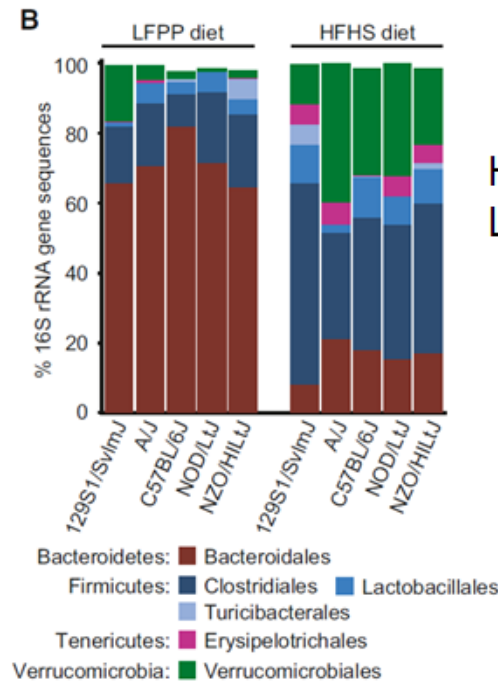
People eating identical meals present high variability in post-meal blood glucose response.



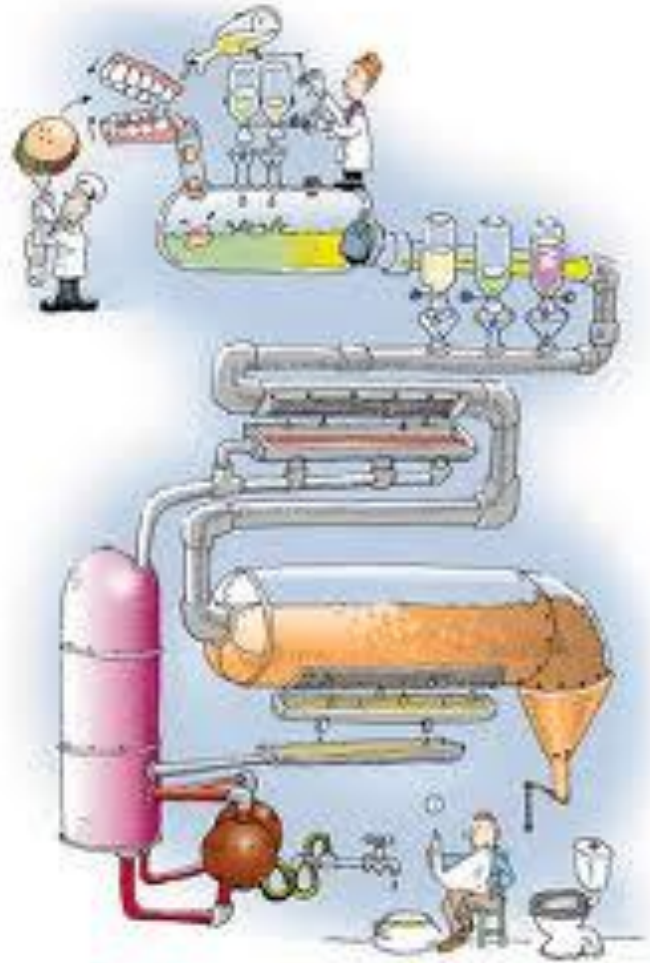
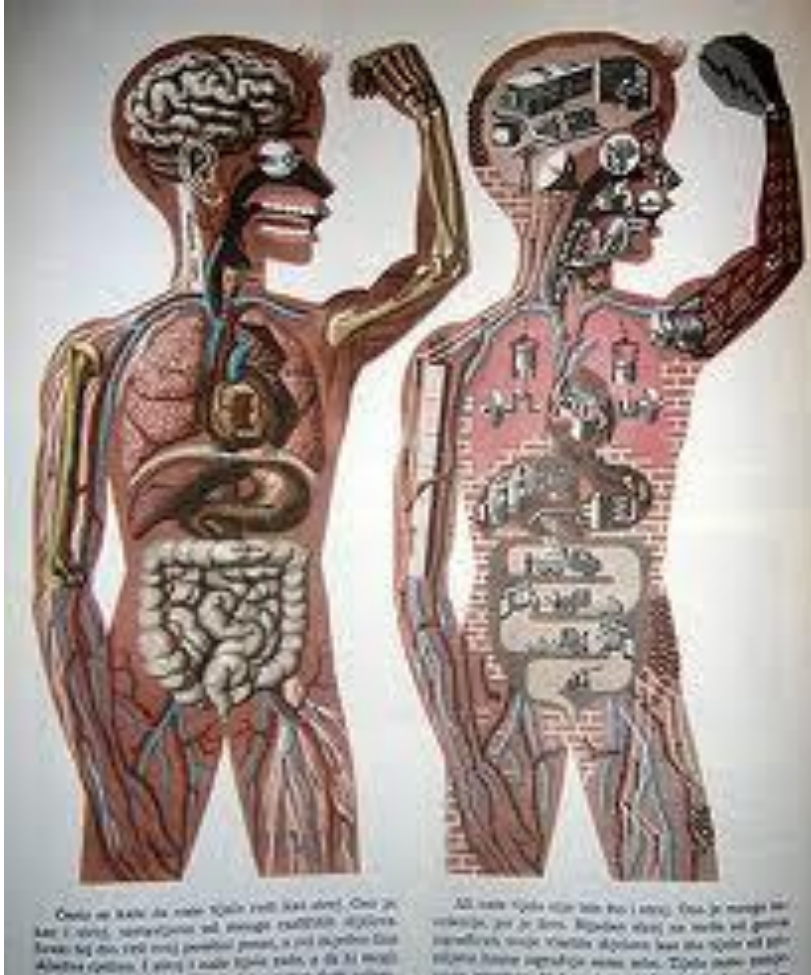
Nutrition: traditional to personalised... Why?

SCIENCE (2)

Diet dominates host genotype in shaping the murine gut microbiota.



Nutrition: {computer, AI}



Nutrition: {computer, AI}

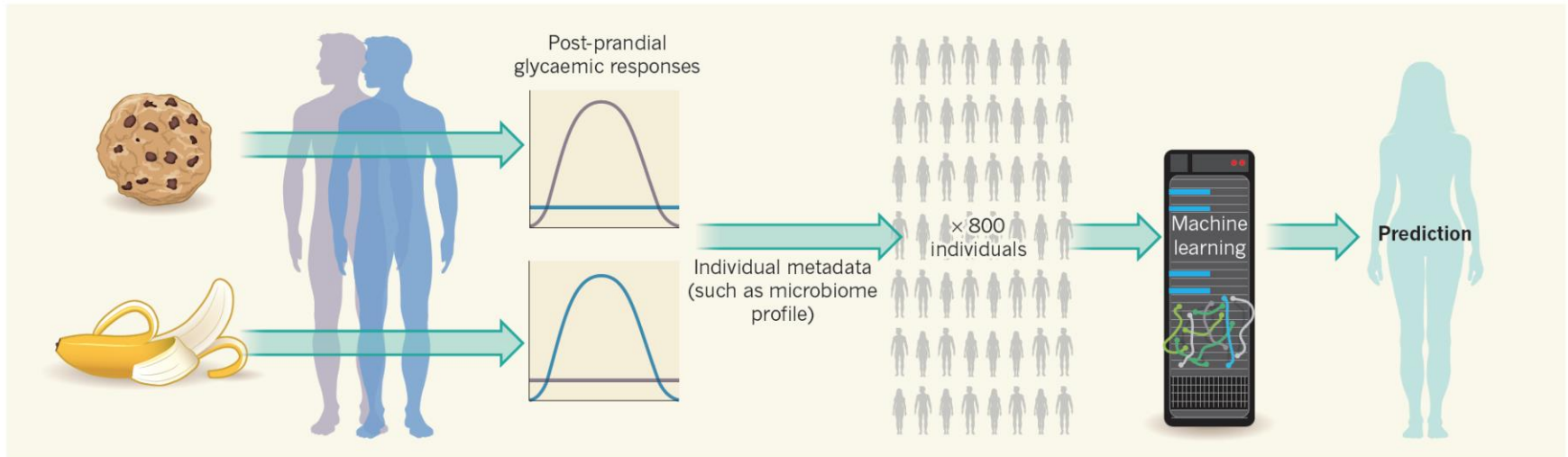
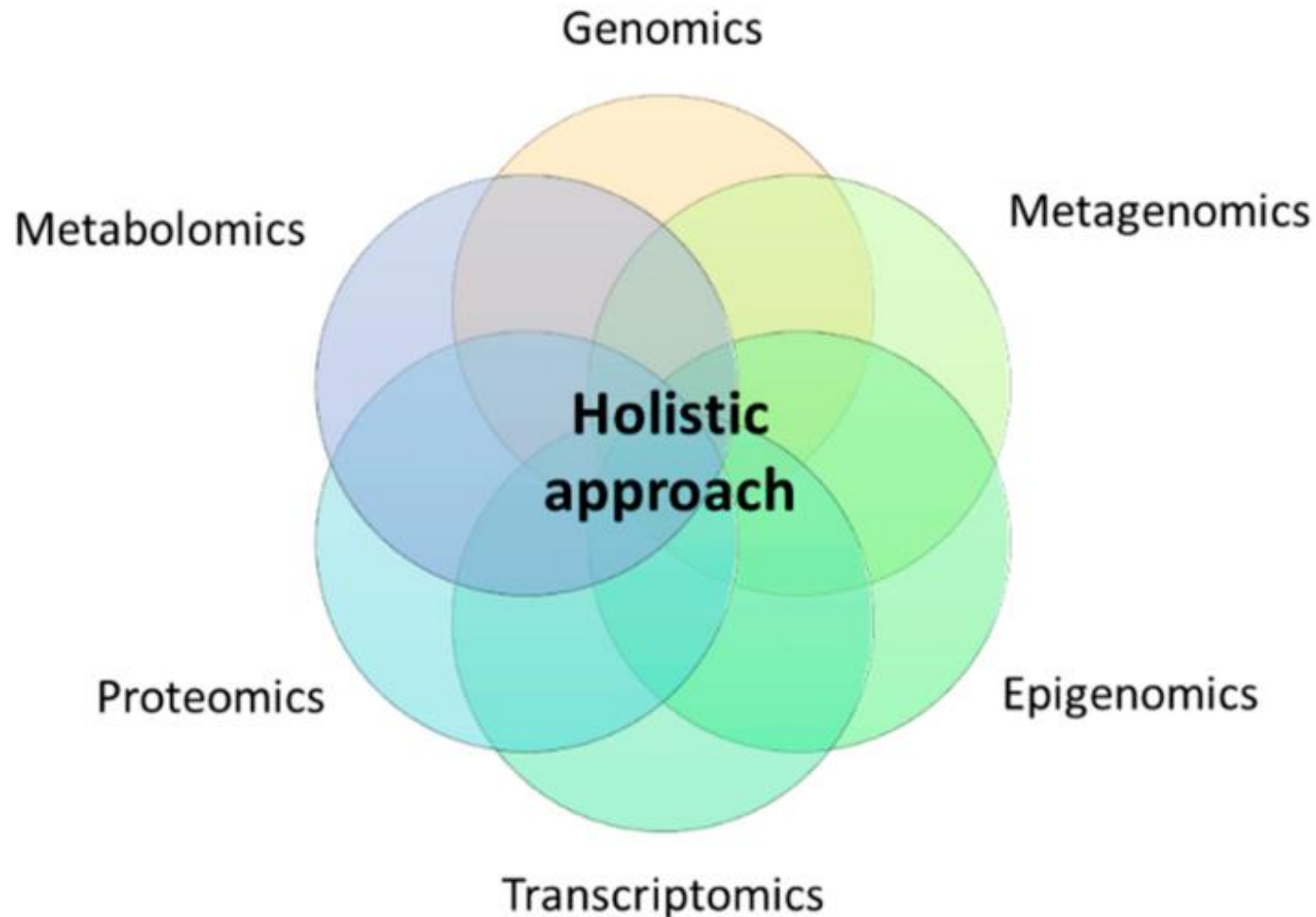


Figure 1 | Machine learning for nutrition advice. Zeevi *et al.*² continuously monitored the blood glucose levels of 800 individuals over the course of a week, which gave an indication of their post-prandial glycaemic responses (PPGRs; a measure of how rapidly blood glucose levels rise after food consumption) to specific foods. They combined this with 137 other measurements from each person, including their body-mass index,

cholesterol levels, diet, activity levels and the composition of their gut microbiome. The data were used to develop a machine-learned algorithm. The authors show that this algorithm can predict PPGRs in people who were not in the cohort used to train the model, and thus can be used to provide dietary recommendations for maintaining PPGRs that are associated with health.

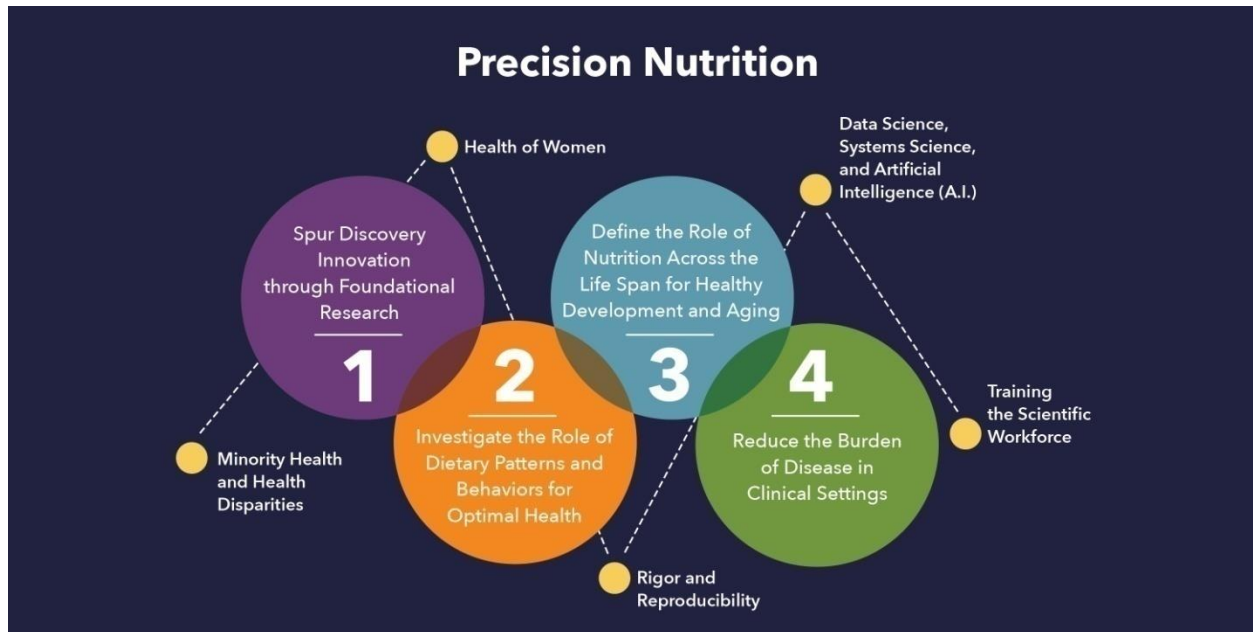
1. [Eric Topol on X: 'Machine learning: you, your diet, #microbiome->what you should eat Great summary @NatureNews https://t.co/bB1nxxRDIQ https://t.co/FOEIr191YE' / X \(twitter.com\)](https://t.co/bB1nxxRDIQ)
2. Sonnenburg, Erica D., and Justin L. Sonnenburg. "A personal forecast." *Nature* 528.7583 (2015): 484-486.

... Why then? personalised to precision: Integration*



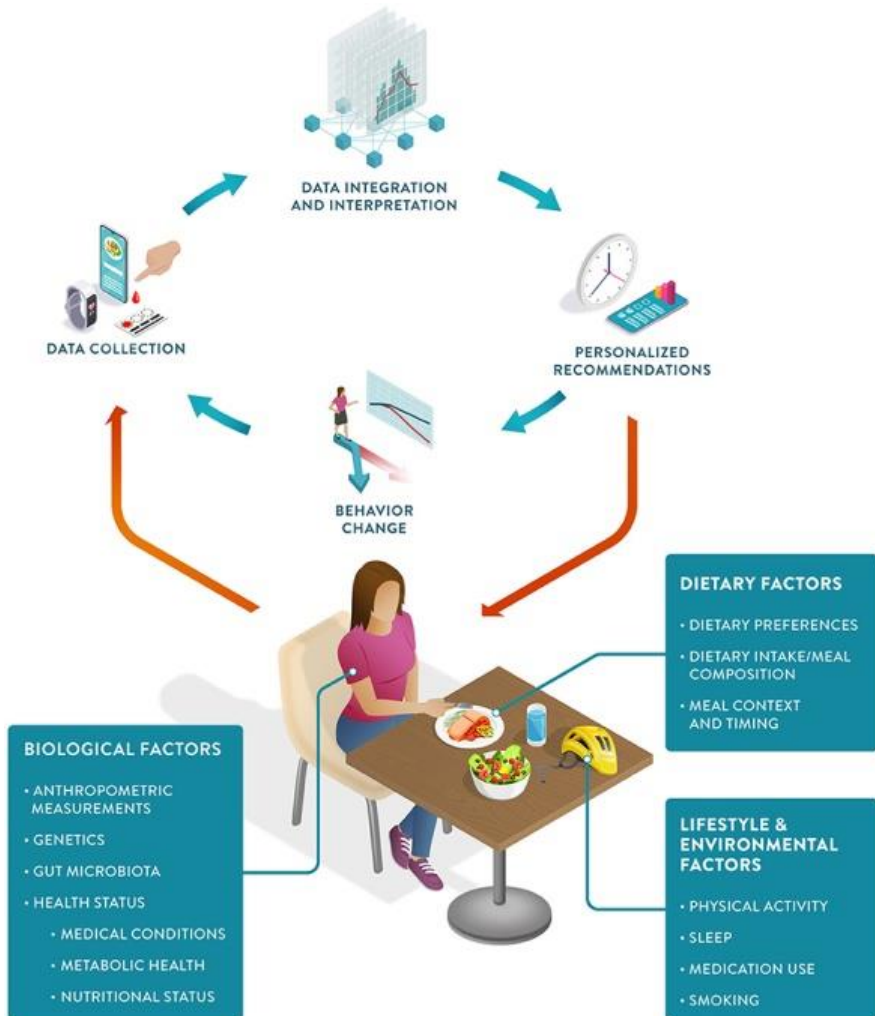
Precision nutrition: Static to Dynamic*

An important distinction between both concepts is that **personalized nutrition** considers genomic and other “omics” features of an individual’s diet and metabolism that are **predominantly fixed and therefore don’t change over time**, whereas **precision nutrition adopts an integrative, dynamic and holistic approach** to developing comprehensive recommendations for individuals and population subgroups (NIH, 2020). [DPCPSI - 2020-2030 Strategic Plan for NIH Nutrition Research](#)

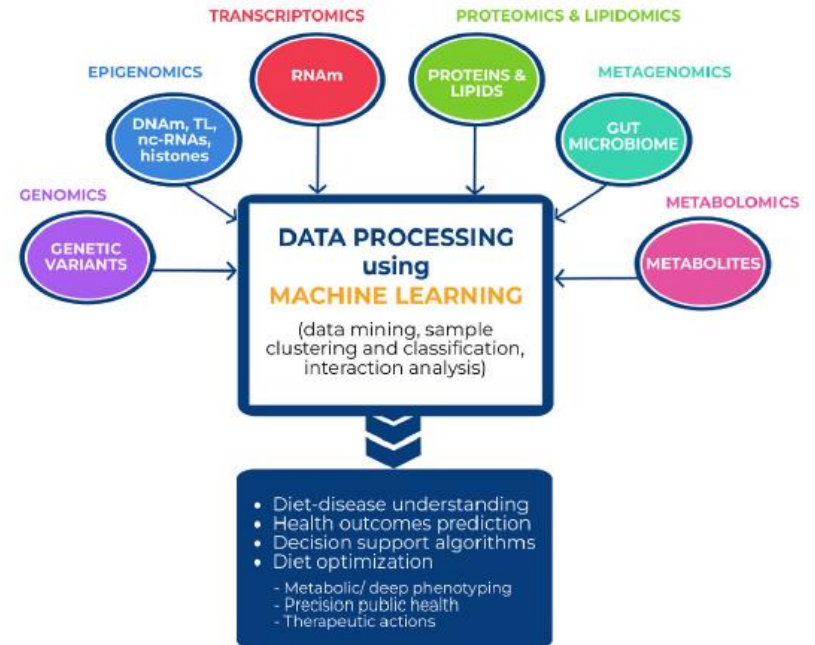


1. Livingstone, Katherine M., et al. "Precision nutrition: A review of current approaches and future endeavors." *Trends in Food Science & Technology* (2022).
2. National Institutes of Health. (2020). 2020–2030 strategic plan for NIH nutrition research. A report of the NIH nutrition research Task force. Retrieved from <https://www.niddk.nih.gov/about-niddk/strategic-plans-reports/strategic-plan-nih-nutrition-research>.

Precision nutrition: In practice (1)



INTEGRATIVE PRECISION NUTRITION



1. Berciano, Silvia, et al. "Precision nutrition: Maintaining scientific integrity while realizing market potential." *Frontiers in Nutrition* 9 (2022): 979665.
2. Livingstone, Katherine M., et al. "Precision nutrition: A review of current approaches and future endeavors." *Trends in Food Science & Technology* (2022)

Precision nutrition: In practice (2)

- **Objective:** Authors*, provide an overview of where and **how machine learning has been used in Precision Nutrition.**

- **Materials:**

- Nine** research questions were defined in this study.
- We retrieved **4930 papers** from electronic databases
- In total, **30 algorithms** were used.

- **Result:**

Personalized approaches are promising to **reduce the burden of these current problems** in nutrition research, and the current review shows **Machine Learning can be incorporated into Precision Nutrition research** with high performance.

- **Conclusions:** Precision Nutrition researchers should consider incorporating **Machine Learning into their methods to facilitate the integration of many complex features**, allowing for the development of high-performance Precision Nutrition approaches.

* Kirk, Daniel, Cagatay Catal, and Bedir Tekinerdogan. "Precision nutrition: A systematic literature review." *Computers in Biology and Medicine* 133 (2021): 104365.

Governance: Ethics, and laws

Stakeholders in the AI field: **AI makers, clinicians, patients, ethicists, and legislators**, must be engaged in the ethical and legal debate on how AI is successfully implemented in practice

3 Ethical

- 3.1 Informed consent to use
- 3.2 Safety and transparency
- 3.3 Algorithmic fairness and biases
- 3.4 Data privacy

4 Legal

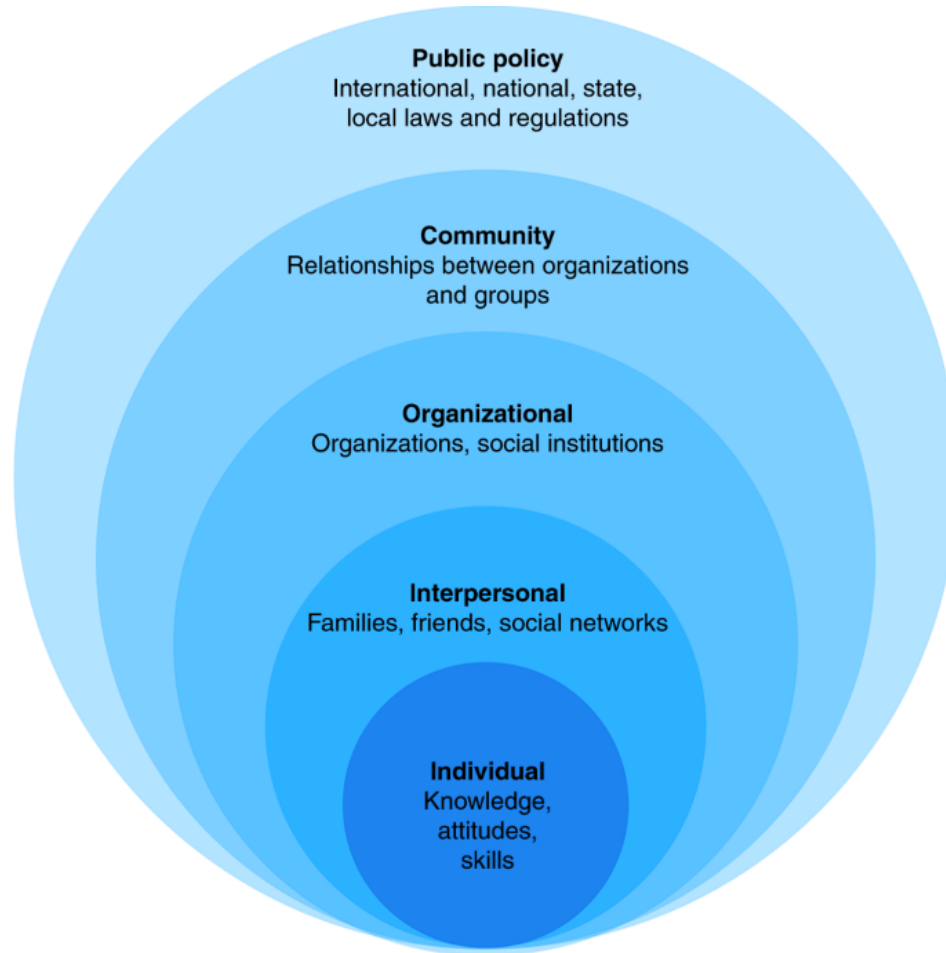
- 4.1 Safety and effectiveness
 - 4.2 Liability
 - 4.3 Data protection and privacy
 - 4.4 Cybersecurity
 - 4.5 Intellectual property law
-



AWARENESS OF RANDOMISATION CAN IMPROVE RESULTS



Thank you for your attendance!



For home:

Machine learning and algorithmic fairness in public and population health.

Mhasawade, Vishwali, Yuan Zhao, and Rumi Chunara, *Nature Machine Intelligence* 3.8 (2021): 659-666.

Questions & Answers



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