

COMMENTARY

The body's microbial pets and artificial intelligence

Hamid Moghaddasi*

Department of Health Information Management and Medical Informatics, School of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Abstract

Human aspirations have consistently centered on reducing mental burdens, prolonging life, and mastering destiny, with science and technology serving as primary tools toward these goals. Artificial intelligence (AI), particularly through machine learning, offers powerful means of transforming data into knowledge and addressing complex biological challenges. At the same time, the human microbiome has emerged as a crucial determinant of health, longevity, and disease resistance. The microbiome, comprising over 38 trillion microorganisms—including bacteria, fungi, protozoa, and viruses—interacts dynamically with the human body. Its collective genetic material exceeds that of the human genome by hundreds of times, positioning it as an equally influential factor in shaping individual destiny. Unlike DNA, the microbiome is highly adaptable and can be reshaped in relatively short periods through diet, lifestyle, or medication. This adaptability creates opportunities for preventive and personalized medical interventions. To illustrate its importance, the microbiome can be conceptualized as the body's "microbial pets." These companions coexist as dining partners and life-long residents whose well-being directly influences human vitality. Like pets, they require proper care—particularly fiber-rich nutrition—and neglect can result in harmful consequences. This metaphor highlights the need to view microbial ecosystems not as passive inhabitants but as active partners in human health. By combining microbiome research with AI, it becomes possible to map these "microbial pets" with precision, uncover hidden interactions, and identify early indicators of disease. Such integration points toward a future where preventive, predictive, and personalized medicine fundamentally reshape human health and extend life expectancy.

***Corresponding author:**Hamid Moghaddasi
(moghaddasi@sbm.ac.ir)

Citation: Moghaddasi H. The body's microbial pets and artificial intelligence. *Artif Intell Health*. 2026;3(3):025340069.
doi: 10.36922/AIH025340069

Received: August 22, 2025**Accepted:** September 4, 2025**Published online:** September 19, 2025

Copyright: © 2025 Author(s). This is an Open-Access article distributed under the terms of the Creative Commons Attribution License, permitting distribution, and reproduction in any medium, provided the original work is properly cited.

Publisher's Note: AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Keywords: Microbial pets; Microbiota; Personalized medicine; Artificial intelligence; Human health

1. Human dreams

Since the day humans found themselves in this mysterious world, they have nurtured three dreams in their minds: first, to reduce their mental burdens; second, to extend their lifespan; and finally, to gain mastery over their destiny. In pursuit of these dreams, numerous individuals across the world and throughout history have made great efforts.^{1,2} Among them are Blaise Pascal, John Craig Venter, Élie Metchnikoff, and also Raymond Kurzweil.

Blaise Pascal, the French mathematician, physicist, and philosopher who was born in 1623 and lived only 39 years, represents the echo of humanity's effort to fulfill the dream of easing mental concerns. Pascal made significant contributions to probability theory as well as fluid mechanics. In his youth, when he observed his father, an accountant, continuing his work at home, he built a mechanical device capable of performing addition and subtraction to reduce his father's mental burden.³

Two individuals are clear examples of humanity's efforts to realize the dream of extending human lifespan. One of them is J. Craig Venter, born in 1946, an innovative scientist in the fields of genetics and genomics. In addition to his work on decoding the human genome, he founded the Institute for Longevity in 2006 with the goal of using genetic data to predict diseases. He is considered a pioneer in a new path of preventive medicine and biotechnology aimed at extending the cycle of healthy human life. The other is Élie Metchnikoff, born in 1845, one of the pioneers of modern medicine and a founder of immunology, who led scientific efforts in the field of increasing human longevity and preventing aging. He was awarded the Nobel Prize in Medicine in 1908 and was a member of the Russian Academy of Sciences as well as a professor at the Pasteur Institute. He had a remarkable influence on preventive medicine, public health, and nutrition. Metchnikoff's theory on the positive effects of probiotics in extending lifespan still inspires research today.^{4,5}

However, the representative of humanity's effort to realize the third dream – namely, man's mastery over his own destiny – is Raymond Kurzweil, born in 1946. He is an American computer scientist, entrepreneur, innovator, futurist, and author of books such as *The Age of Intelligent Machines*, *The Age of Spiritual Machines*, *The Singularity is Near*, and *How to Create a Mind*. Kurzweil is a public advocate of futurism and transhumanism movements, and through public lectures, he shares his optimistic vision of life-extension technologies and the future of nanotechnology, robotics, and biotechnology.

The technological singularity emphasizes the idea that humans will transfer their intelligence to machines, and that machines will reach a level of intelligence enabling them to create ever-smarter versions of themselves, rapidly accelerating the growth of intelligence. If humans can harness this replicated intelligence within the digital environment, they may then gain mastery over themselves and the world around them.

Ray Kurzweil is a renowned futurist and inventor who believes that technology will enable humans to take control of their own destiny. He predicts that in the near future,

a “technological singularity” will occur – a moment when artificial intelligence (AI) surpasses human intelligence and triggers rapid advancements. His book *The Singularity is Near* explains these ideas and their implications for humanity.

The technological singularity is a point in the future where AI reaches a level of self-awareness and the ability to enhance itself, enabling it to create more advanced versions without human involvement. This explosive growth would lead to accelerated, unpredictable, and irreversible transformations in technology, society, and even human destiny, in ways that humans would no longer be able to fully comprehend or control.

Transhumanism is a philosophical perspective that holds the belief that humans can enhance their physical and mental abilities through technology. Its goal is to transcend natural limitations such as disease, aging, and even death. This movement envisions a future in which humans transform into superior beings, or “post-humans.” Transhumanism asserts that with technology, humanity can overcome disability, illness, aging, and even mortality. In this sense, humans are no longer bound by their biological and genetic destiny, but instead can design and reconstruct themselves, thereby gaining greater control over their bodies and their lives.

This vision is deeply connected to the concept of technological singularity, because at the moment when AI surpasses human understanding and capability, the tools and technologies on which transhumanism depends may rapidly advance and become feasible. In fact, the singularity may mark the point at which transhumanism becomes reality, fundamentally transforming humanity – not only physically but also in terms of identity and meaning.

Importantly, if this moment is guided wisely, it could become the greatest tool for shaping the collective destiny of humankind – for example, by ending poverty, eradicating disease, or even eliminating the need for physical labor.⁶

2. Human and AI

The concept of AI traces back to the efforts of Alan Mathison Turing and John McCarthy. In 1950, Turing, in his landmark paper *Computing Machinery and Intelligence*, posed the question: Can a machine think? His work was later advanced by McCarthy, who organized workshops at Dartmouth College in the United States in 1956 and introduced the term “artificial intelligence,” popularizing it. Alan Mathison Turing was an English mathematician, computer scientist, logician, cryptographer, philosopher,

and theoretical biologist. He had a profound impact on the development of theoretical computer science and provided a formal foundation for it by introducing concepts such as algorithms and computation through the Turing machine. Turing is widely regarded as the father of theoretical computer science and AI.

In 1950, Turing conducted an experimental human probe to distinguish between human and machine thinking. This effort, known today as the Turing Test, requires natural language, knowledge representation, automated reasoning, and machine learning, and can now be fully implemented with the help of computer vision and robotics. Today, the inverse of this test is used to verify human users, commonly known as CAPTCHA.

John McCarthy (September 4, 1927–October 24, 2011) was an American computer scientist and cognitive scientist. He is considered one of the founders of AI and was one of the authors of the paper that coined the term “artificial intelligence.” McCarthy developed the family of Lisp programming languages, had a significant influence on the design of the ALGOL language, popularized the concept of time-sharing, and invented the garbage collection mechanism. He received numerous awards and honors, including the Turing Award in 1971 for his achievements in the field of AI.⁷

McCarthy defined intelligence as the computational function of the brain that enables goal-directed behavior, noting that it exists in varying forms and degrees across humans, animals, and certain machines. When asked what AI is, he replied that it is the knowledge and engineering involved in building intelligent machines, particularly intelligent computer programs. AI is related to tasks performed using computers to understand human intelligence, but it should not be limited to methods that are biologically observable to us.

Regarding whether a definitive definition of AI exists that distinguishes it from human intelligence, he stated: Not yet, because the problem is that we still cannot generally determine which kinds of computational procedures should be called intelligent. We have only

understood some mechanisms of intelligence, while many others remain unknown.⁸

Some of the benefits of AI include more powerful and practical computers, new and improved user interfaces, the ability to solve novel problems, better information management, reduction of information overload, and most importantly, the transformation of information into knowledge.

AI is explored in two main branches: the software branch, known as machine learning, and the hardware branch, known as robotics. Before the advent of AI, we could only obtain information from computers by inputting data and software. However, with the emergence of AI, the world of software production has undergone a profound transformation. By inputting data, information, and knowledge into computers, we can now generate algorithms, which are the core of any software. Algorithm generation means it is possible to produce software capable of solving our problems.⁹

Figure 1 simply illustrates the process of using machine learning. The first step is to utilize high-quality databases, which can even be created by combining diverse datasets. Next, the important variables – each with different weight coefficients that shape the model structure – are identified through a process known as feature selection. In the following stage, one or more machine learning methods are applied to model, train, and test the system. The resulting model is considered an algorithm, which ultimately leads to the development of problem-solving software.¹⁰

In the use of machine learning, the AI specialist is considered the gardener, the data serves as the nutrients, the algorithm represents the seeds, and the resulting software is regarded as the plant or sapling that grows.¹¹

The reasons for failure in using machine learning include: asking the wrong question, attempting to solve the wrong problem, insufficient data, inappropriate data, having too much data, hiring unsuitable personnel, using incorrect tools, lacking an appropriate model, and not having proper evaluation metrics.¹²

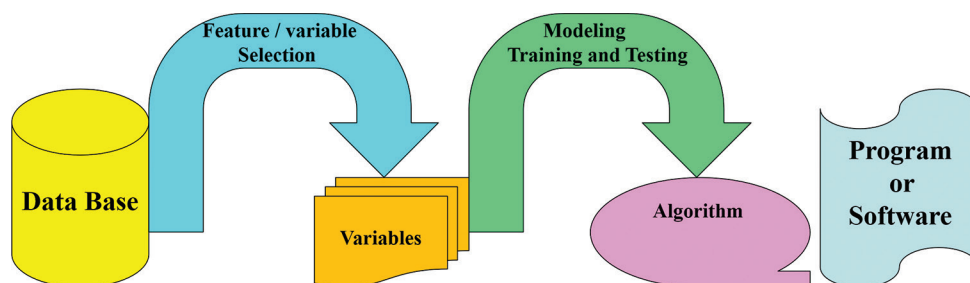


Figure 1. Simple illustration of the machine learning utilization process. Image created by the author.

3. Microbial pets of our body

Now, let us return to the topic of human dreams. Ancient thinkers believed that we are what we eat. Hippocrates' famous saying, "Let your food be your medicine, and your medicine be your food," strongly reflects this belief. But do we eat food solely for ourselves? To answer this question, we must understand the human microbiota, which are essentially the body's "microbial pets" that shape our destiny.

At this point, I intend to introduce the microbial organisms in our body as our ever-present pets – important beings that inhabit our bodies and, in other words, can be considered our dining companions.

We all knew that microbes live in our stomach and intestines, coexisting peacefully with us, and are commonly referred to as the natural flora. These are the human microbiota, which should be considered as the "microbial pets" of our body. Scientific studies have shown that these pets do not only inhabit the stomach and intestines but are present throughout the human body, forming an extensive network, with the human gut being recognized as the "second brain."

While it was once thought that they were limited to bacteria, it has been proven for more than two decades that in addition to bacteria, they include fungi, protozoa, and viruses. The word "pet" is Scottish in origin, meaning "dearest child." In this article, I have chosen to use the term "pet" for microbiota so that you can regard them as very dear beings.

Importantly, these microbial pets play a major role in determining our health, well-being, mood, longevity, and even body weight. Microbiome researchers believe that the microbiome can play a role as significant as DNA in shaping our individual destiny.¹³⁻¹⁵

The intestines, as our second brain and the central hub of the body's microbiota network, are an anatomical site that must be trusted and respected. The saying "trust your gut" seems to be literally true. Researchers are working to show that what happens in the stomach, intestines, and other parts of the body has a significant – and often overlooked – impact on our quality of life.

The microbial pets in our body, who are our dear dining companions, coexist with us as prokaryotes, eukaryotes, and viruses. Remember, when you eat, provide them with fiber-rich foods that they love. They are not like dogs, who remain loyal after a single act of care; rather, they are cat-like, and if neglected, they can turn against us.^{16,17}

Microbiota is a term used to describe the millions of living microorganisms that coexist peacefully with us and

are considered the microbial pets of our body. In contrast, the term microbiome refers to all the genetic information of these microorganisms, as well as their chemical products and effects on our body.¹⁸

Always remember to see yourself as accompanied by these microbial pets, which are abundant and widespread guests in your body (Figure 2).

To make sure I do not forget them, I look at my hands like this (Figure 3).

4. DNA influenced by the microbiome

The microbiome, like DNA, is astonishingly complex, and interestingly, their number in our body exceeds 38 trillion. Even more fascinating and strange is that the genetic material of these beloved guests is 400 times larger than our own genome. The important question is: how can we understand our destiny without accurately identifying the microbial pets in our body? Most importantly, analyzing the gut flora of even a single person could take a lifetime—or even multiple lifetimes.¹⁹

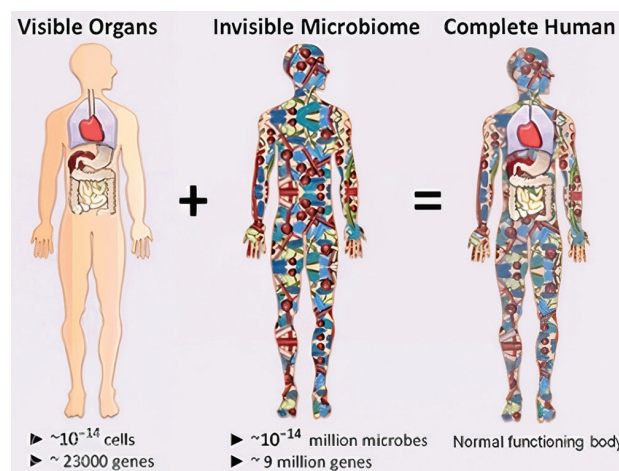


Figure 2. Microbial pets, which are widespread guests in your body. Image created by the author.



Figure 3. Microbial pet and our hands. Image created by the author.

Yes, as I mentioned, we must know our fellow “tablemates” precisely to take good care of them. With the help of AI and the most advanced computational hardware, this can be done in just a few minutes; in a way that allows us to virtually identify every microbe in a person’s ecosystem, detect patterns and changes that are invisible to the human eye, and analyze the interactions among them.²⁰

The goal of microbiome research, such as the “Human Microbiome Project” by the U.S. National Institutes of Health, which began in 2017, is to demonstrate the possibility of identifying and analyzing the human microbiome, with the hope that it will lead to better diagnosis and more effective treatments for diseases.²¹

When it comes to technology and human health, in recent years, the media’s focus has largely been on genetics. The DNA sequencing project in the Human Genome Project, which was completed in 2003, succeeded in mapping all 20,500 human genes composed of 3 billion chemical base pairs. Today, scientists know the exact location of each gene on the DNA strand and its potential function, enabling the development and prescription of personalized medical treatments for each individual.²²

One of the most exciting yet also confusing aspects of genomic and microbiome research is the window it may open onto the future. What do our DNA and microbiome reveal about us today and tomorrow? What predictions do they offer about our health? Which diseases or disorders are we susceptible to?

In genetics, scientists look for defects or mutations in individual genes or groups of genes to determine how susceptible a person might be to certain diseases or disorders, such as Alzheimer’s disease or diabetes. In the future, treatments may involve replacing or repairing defective genes – a process known as gene therapy. But for now, we work with the genes we have, and the best we can do is choose a healthy lifestyle that increases our chances of better health. However, an individual’s microbiome may be modifiable – relatively quickly – through dietary changes, certain medications, and even exercise.^{20,23}

Therefore, the ability to detect early or imminent signs of disease through gut analysis can be extremely valuable and even vital for improving our health and potentially increasing our lifespan.

5. Identifying human microbiome patterns with AI

Today, science is using machine learning (AI) to gradually record the microbiome signatures of more and more individuals over time, to identify changes that are indicative of imminent onset of disease. Researchers may

also discover ways to prevent or even treat illnesses by manipulating the microbiome. If we accept the premise that each person’s microbiome is as unique as a fingerprint or paradigm, then treatments could also be tailored to an individual’s specific genetic mutations and microbiome composition. For this reason, researchers are striving to move beyond simple diagnostics toward preventive and personalized medicine.²⁴

AI algorithms can assist the medical field in better understanding the complex composition and interactions of the microbiome, uncovering connections that may not be observable by human researchers. The results of these efforts could lead to significant advancements in the treatment of a wide range of diseases, including diabetes, cancer, and other conditions.²³

Acknowledgment

None.

Funding

None.

Conflict of interest

The author declares no conflict of interest.

Author contributions

This is a single-authored article.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

Not applicable.

References

1. Queyras J. *The Human in Machine-Made Art. Presented at: xCoAx 2023: 11th Conference on Computation, Communication, Aesthetics*; 2023. Weimar, Germany. Available from: <https://2023.xcoax.org/pdf/queyras.pdf> [Last accessed on 2025 Sep 18].
2. Batista HR, Hagler J. *Humans and Machines: A Study of the Impacts of the Technological Advances in the Light of Generative Art Theory. 27th International Symposium on Electronic Art*; 2022. Barcelona, Spain. 2022:532-538.
3. Davidson HM. *Pascal and the Arts of the Mind*. Cambridge: Cambridge University Press; 1993.
4. Purnick PEM, Weiss R. The second wave of synthetic

- biology: From modules to systems. *Nat Rev Mol Cell Biol.* 2009;10(6):410-422.
doi: 10.1038/nrm2698
5. Stambler I. Elie Metchnikoff-the founder of longevity science and a founder of modern medicine: In honor of the 170th anniversary. *Adv Gerontol.* 2015;5(4):201-208.
doi: 10.1134/S2079057015040219
6. Korotayev AV. The 21st century singularity and its big history implications: A re-analysis. *J Big Hist.* 2018;2(3):17-71. [Article in Russian]
doi: 10.22339/jbh.v2i3.2310
7. Smith C, McGuire B, Huang T, *et al.* *The History of Artificial Intelligence. History of Computing CSEP 590A University of Washington December 2006.* Available from: <https://www.studocu.com/row/document/university-of-nairobi/fundamentals/of/financial-accounting/history-ai-its-an-history-on-information-technology/8171109> [Last accessed on 2025 Sep 18].
8. McCarthy J. *What is Artificial Intelligence?* Available from: <https://www-formal.stanford.edu/jmc/whatisai.pdf> [Last accessed on 2025 Sep 18].
9. Bhosale S, Pujari V, Multani Z. Advantages and Disadvantages of Artificial Intelligence. In: *National Seminar on "Trends in Geography, Commerce, IT and Sustainable Development"*. Khed, India; 2020.
10. Figueiredo LM. *An Overview of the Main Machine Learning Models: From Theory to Algorithms. Master's Dissertation.* NOVA Information Management School, Instituto Superior de Estatística e Gestão de Informação, Universidade Nova de Lisboa; 2020. Available from: <https://run.unl.pt/bitstream/10362/110804/1/TAA0070.pdf> [Last accessed on 2025 Sep 18].
11. Gunde S. Think Like a Gardener: The Ultimate Metaphor for Understanding AI. *Medium.* Posted June 24, 2025. Available from: <https://medium.com/@snehalgunde11/think-like-a-gardener-the-ultimate-metaphor-for-understanding-ai-fdc9a2b831ca> [Last accessed on 2025 Sep 18].
12. Ryseff J, De Bruhl BF, Newberry SJ. *The Root Causes of Failure for Artificial Intelligence Projects and How They Can Succeed.* United States: RAND Corporation; 2024.
13. Drees BM, Barthel B. We are what we eat. *Mo Med.* 2022;119(5):479-480.
14. Smith R. Let food be thy medicine. *BMJ.* 2004;328(7433):211.
doi: 10.1136/bmj.328.7433.0-g
15. Dictionary.com. Available from: <https://www.dictionary.com/browse/pet> [Last accessed on 2025 Sep 04].
16. Stronge SM, Prudhvi S. The gut: The body's second brain. *Graph Med Rev.* 2024;4(1):e940.
doi: 10.7191/gmr.940
17. Korn LE. The second brain: Trust your gut. *Neuropsychotherapist.* 2016;4(12):30-51.
18. Colella M, Charitos IA, Ballini A, *et al.* Microbiota revolution: How gut microbes regulate our lives. *World J Gastroenterol.* 2023;29(28):4368-4383.
doi: 10.3748/wjg.v29.i28.4368
19. Goodrich JK, Davenport ER, Clark AG, Ley RE. The relationship between the human genome and microbiome comes into view. *Annu Rev Genet.* 2017;51:413-433.
doi: 10.1146/annurev-genet-110711-155532
20. Micron Technology. *We are What We Eat: AI and the Human Microbiome;* 2019. Available from: <https://my.micron.com/about/blog/applications/ai/we-are-what-we-eat-ai-and-the-human-microbiome> [Last accessed on 2025 Sep 18].
21. Peterson J, Garges S, Giovanni M, *et al.* The NIH human microbiome project. *Genome Res.* 2009;19(12):2317-2323.
doi: 10.1101/gr.096651.109
22. Collins FS, Fink L. The human genome project. *Alcohol Health Res World.* 1995;19(3):190-195.
23. Institute of Medicine (US) Committee on Assessing Interactions Among Social, Behavioral, and Genetic Factors in Health. *Genes, Behavior, and the Social Environment: Moving Beyond the Nature/Nurture Debate.* In: Hernandez LM, Blazer DG, editors. *The National Academies Collection: Reports funded by National Institutes of Health.* Washington (DC): National Academies Press (US); 2006.
24. Rozera T, Pasolli E, Segata N, Ianiro G. Machine learning and artificial intelligence in the multi-omics approach to gut microbiota. *Gastroenterology.* 2025;169(3):487-501.
doi: 10.1053/j.gastro.2025.02.035