



Artificial intelligence (AI)-driven diet-intestinal microbiota-host health integration: A four-dimensional paradigm for advancing host wellness research

Tianle He^{1,2,3,4#}, Shuobo Zhang^{1,2#}, Jiaxin Chen^{1,2}, Xiaoling Zheng^{1,2}, Jixin Zhao^{1,2},
Huifeng Li^{1,2}, Jiani Mao^{1,2}, Ju Luo^{1,2}, Jundan Zheng^{1,2}, Dengjun Ma^{1,2}, Lihong Wang^{1,2},
Junhui Liu^{1,5,6}, Wen Tian⁷, Shuangming Yang^{3,4}, Chengli Liu^{1,8}, Ke Tian^{1,9}, Zhenguo Yang^{1,2*}

¹College of Animal Science and Technology, Southwest University, Chongqing, China.

²Key Laboratory of Animal Nutrition and Bio-feed,

Chongqing Municipal Education Commission, Chongqing, China.

³College of Animal Science and Technology, Ningxia University, Yinchuan, China.

⁴Ningxia Key Laboratory of Precision Breeding and Nutritional Regulation of
Characteristic Livestock and Poultry, Ningxia University, Yinchuan, China.

⁵Plant and Animal Genomics, Centre for Research in Agricultural Genomics (CRAG),
CSIC-IRTA-UAB-UB Consortium, Bellaterra, Spain.

⁶Departament de Ciència Animal i dels Aliments, Facultat de Veterinària,
Universitat Autònoma de Barcelona (UAB), Bellaterra, Spain.

⁷Hunan Provincial Key Laboratory of Animal Nutritional Physiology and
Metabolic Process, National Engineering Laboratory for Pollution Control
and Waste Utilization in Livestock and Poultry Production, Institute of
Subtropical Agriculture, Chinese Academy of Sciences, Changsha, China.

⁸College of Biology and Food Engineering, Chongqing Sanxia University
of Science and Technology, Chongqing, China.

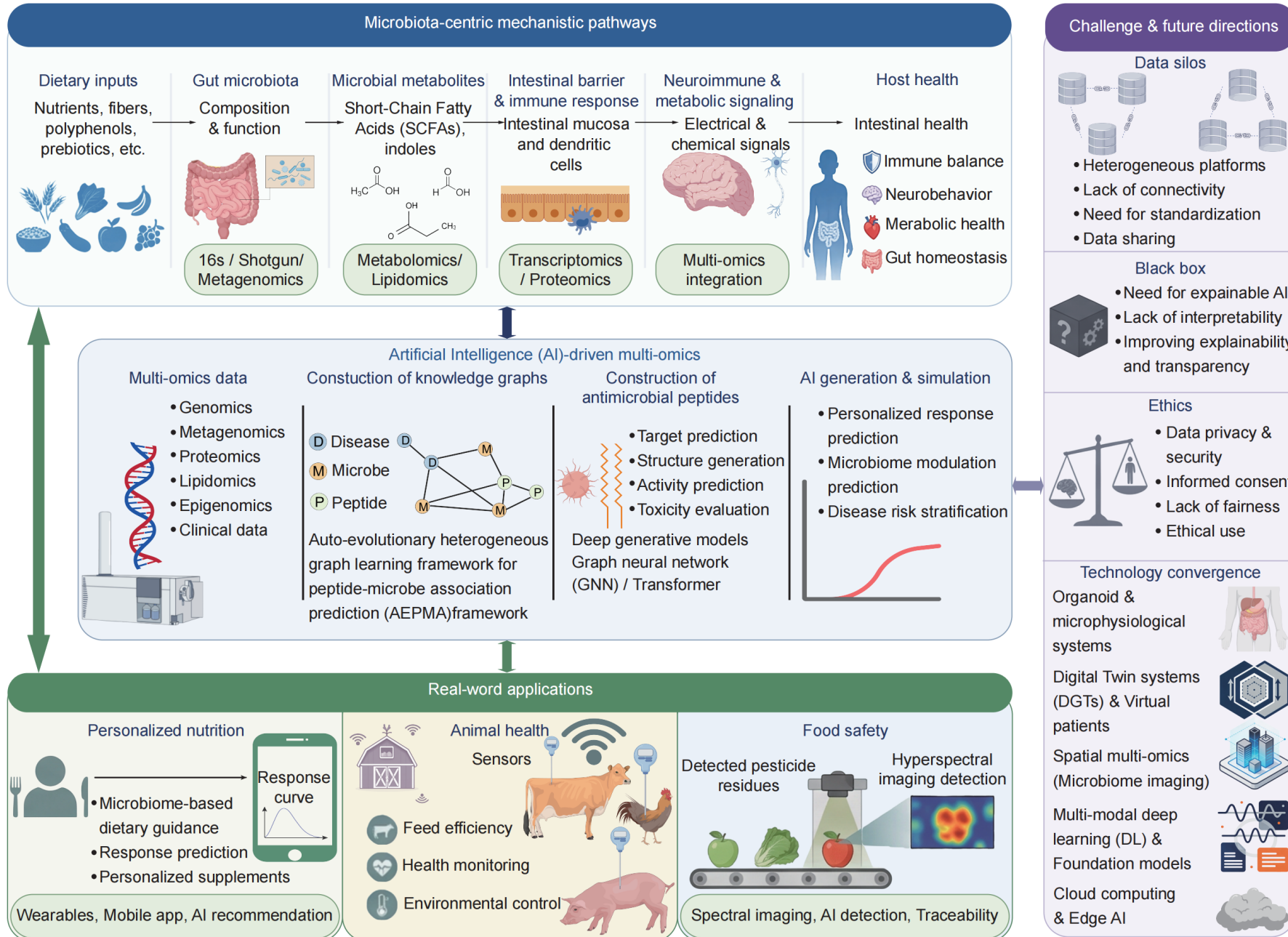
⁹The United Graduate School of Agricultural Science, Gifu University, Japan.



Tianle He, Shuobo Zhang, Jiaxin Chen, Xiaoling Zheng, Jixin Zhao, Huifeng Li, Jiani Mao, et al. 2026.

Artificial intelligence (AI)-driven diet-intestinal microbiota-host health integration: A four-dimensional paradigm
for advancing host wellness research. *iMetaOmics* 3: e70133. <https://doi.org/10.1002/imo2.70133>

Highlights



- Proposes an Artificial Intelligence (AI)-driven four-dimensional diet-intestinal microbiota-host health paradigm.
- Elucidates AI advances in deciphering bidirectional diet-microbiota interactions.
- Evaluates AI-driven precision nutrition intervention designs and clinical translation.
- Critically analyzes inherent limitations of microbiome AI models while outlining key challenges and future directions.

AI-decoded microbiota-mediated nutritional signaling and host health

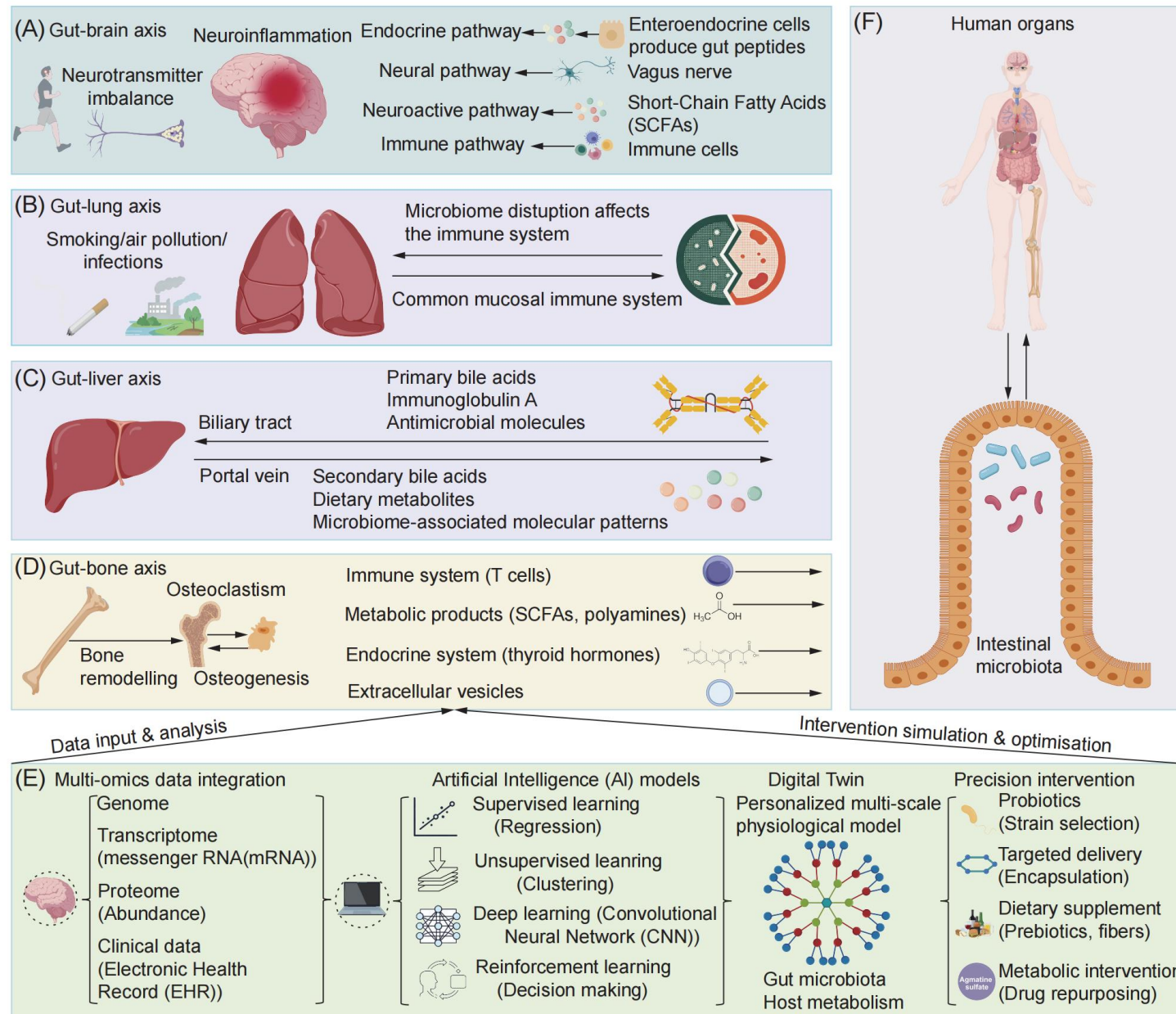


Figure 1 Artificial intelligence (AI)-assisted integration of gut-organ axes.

AI-enabled cross-species translation and the one health framework

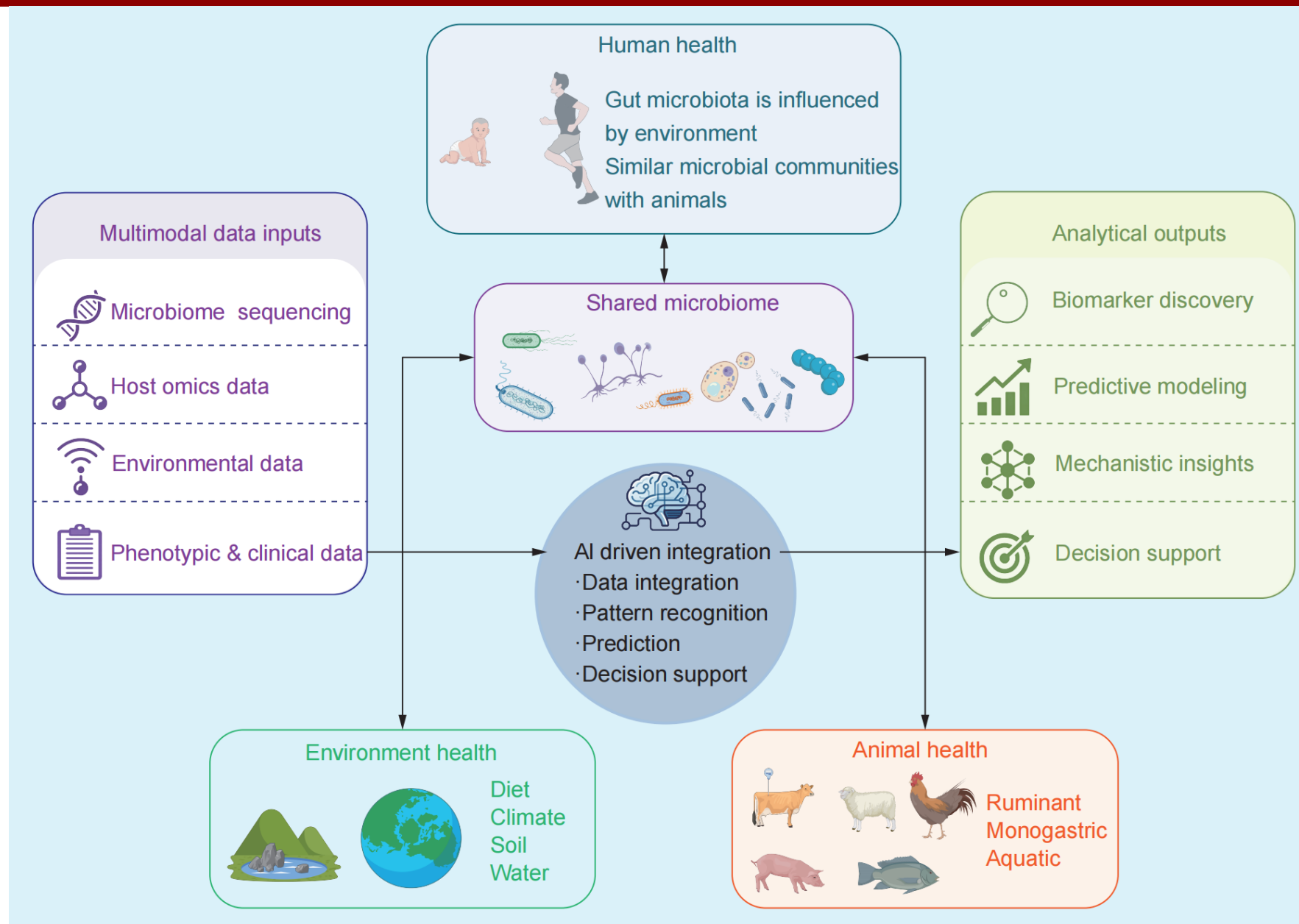


Figure 2 Cross-species extension of the four-dimensional framework.

AI-integrated multi-omics for redefining microbial modulation strategies

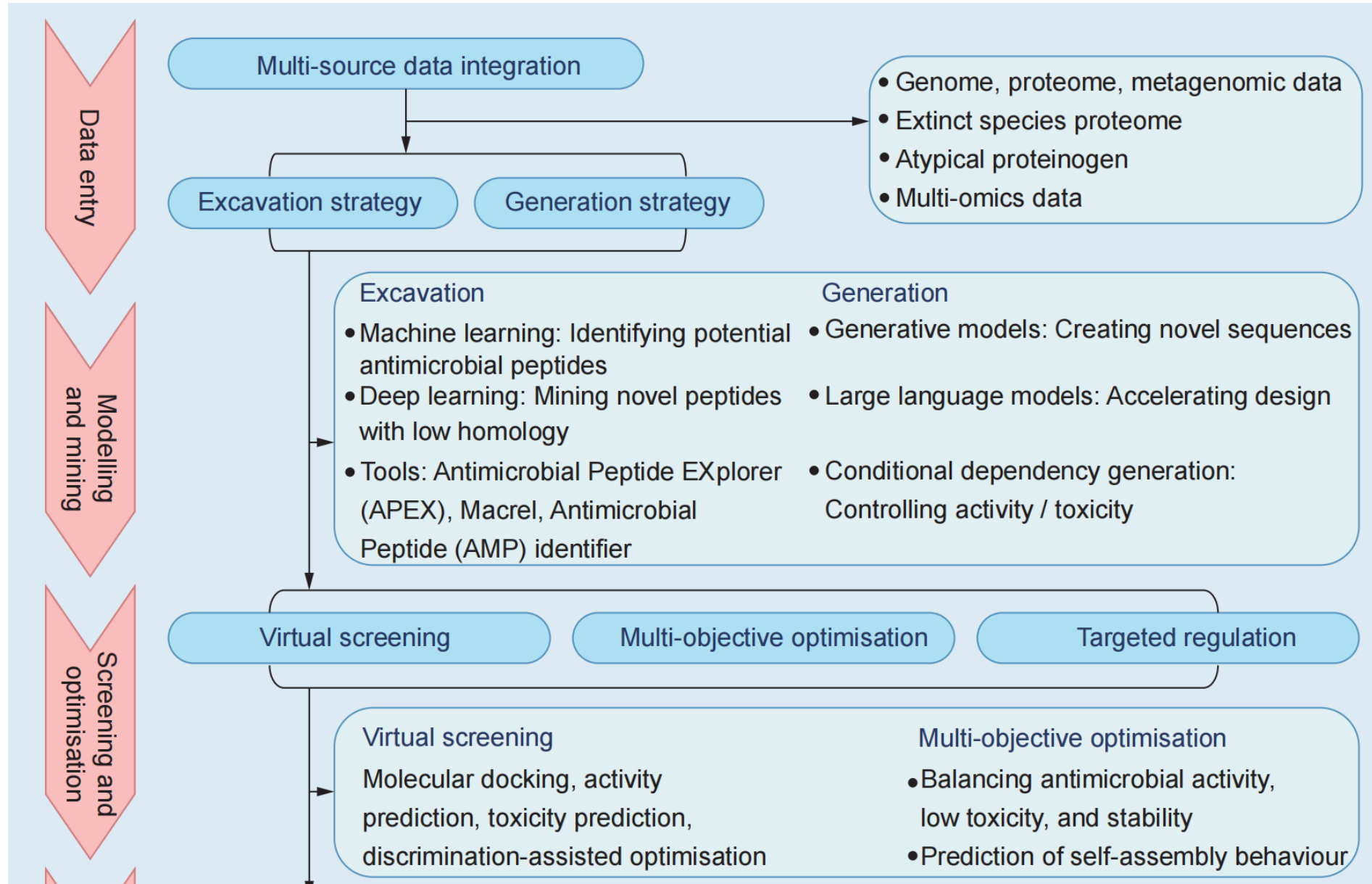


Figure 3 AI-assisted workflow for the discovery of microbiome-derived antimicrobial peptides.

AI-integrated multi-omics for redefining microbial modulation strategies

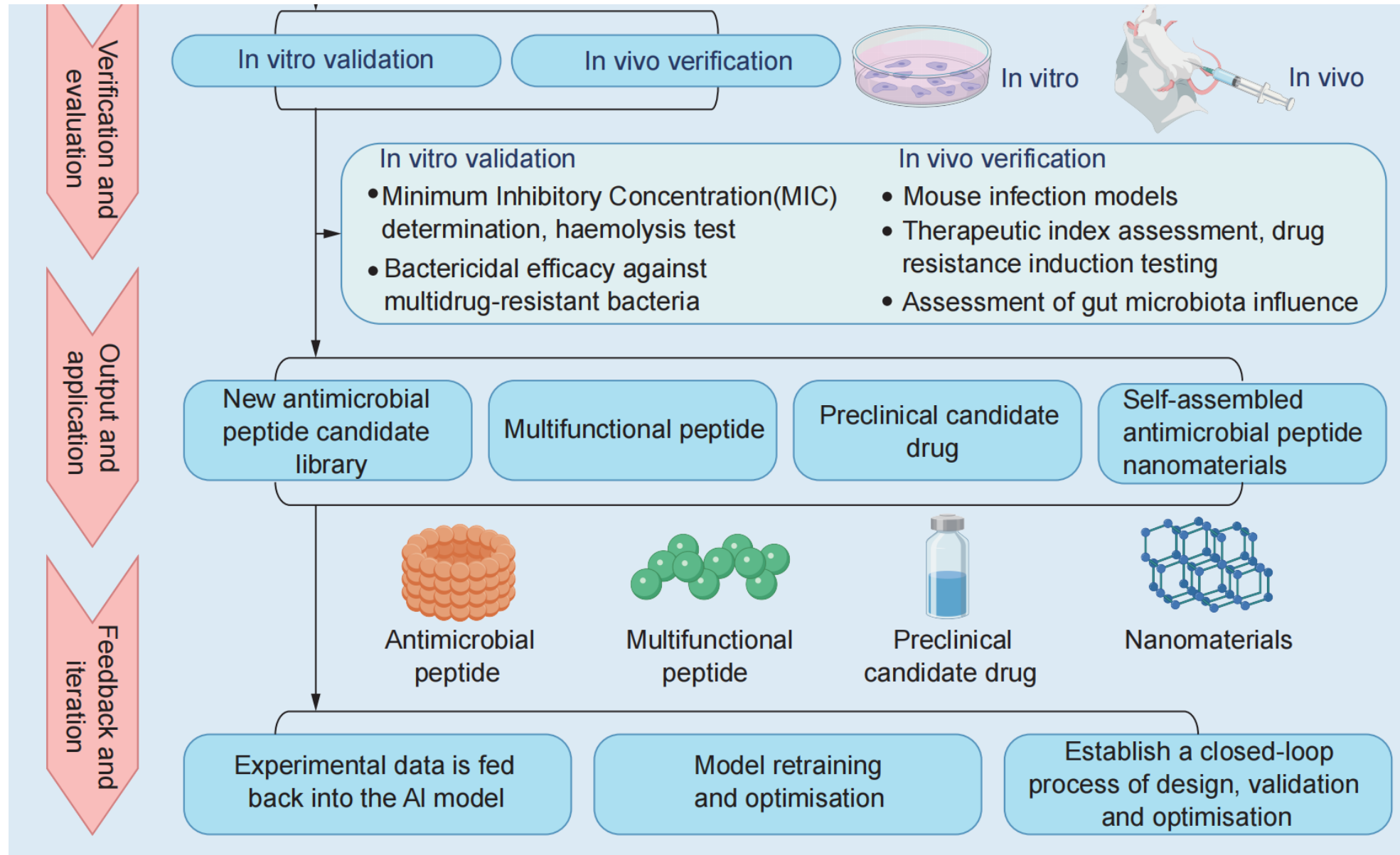


Figure 3 AI-assisted workflow for the discovery of microbiome-derived antimicrobial peptides.



AI-empowered precision nutrition and digital intestinal twins

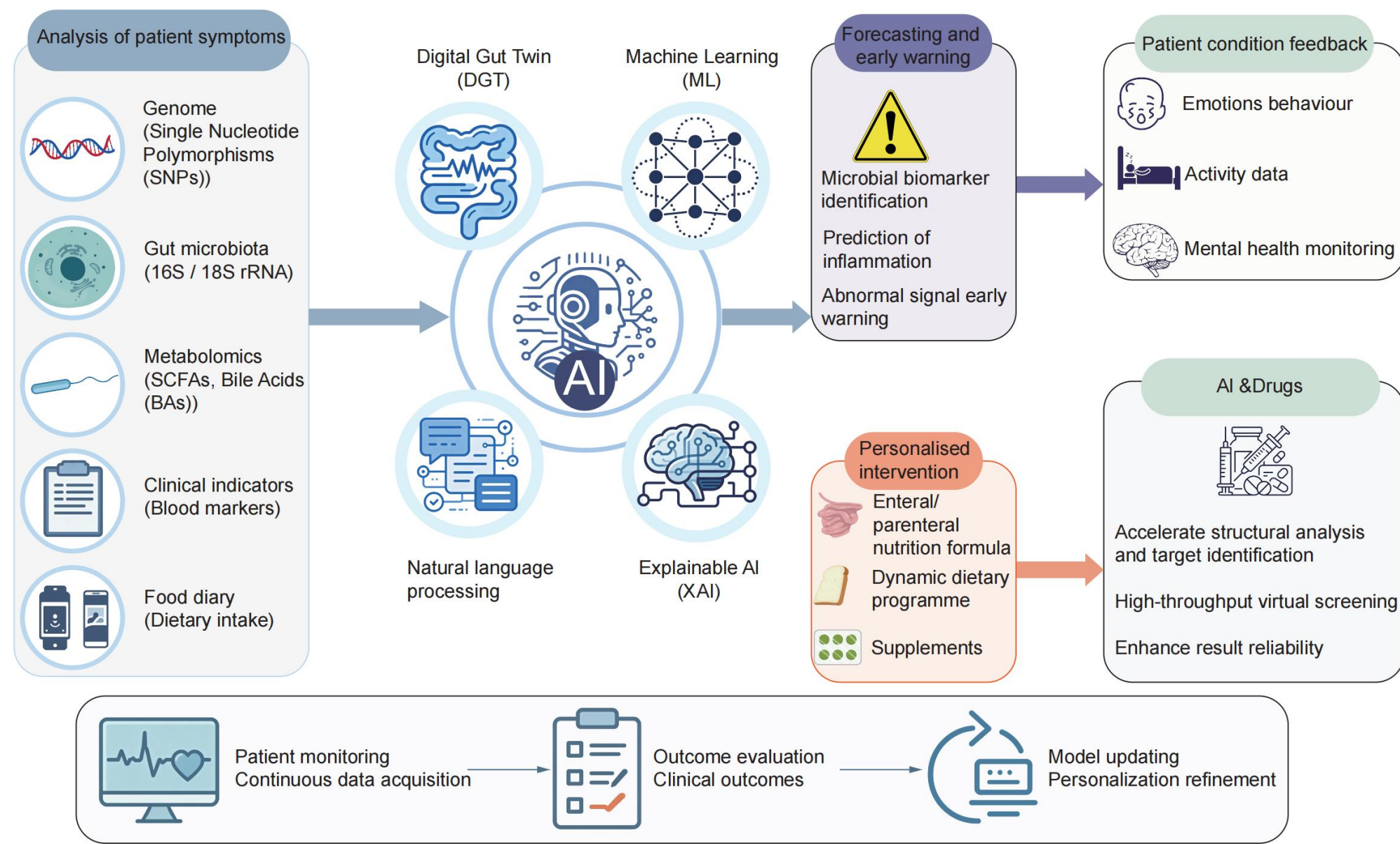


Figure 4 AI-enabled integration of multimodal patient data for biomarker identification and personalised health management.

AI-facilitated development of healthy animal farming systems

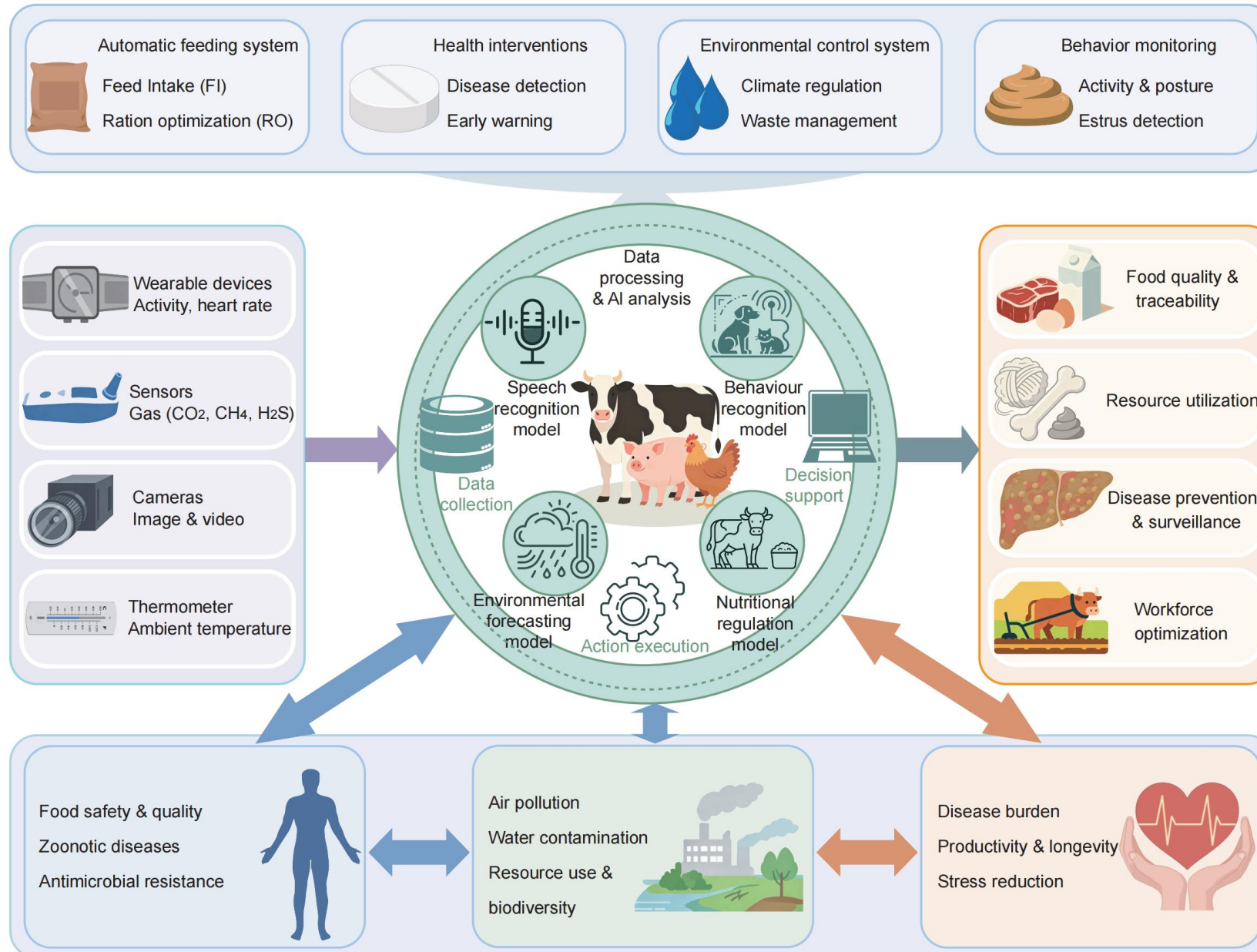
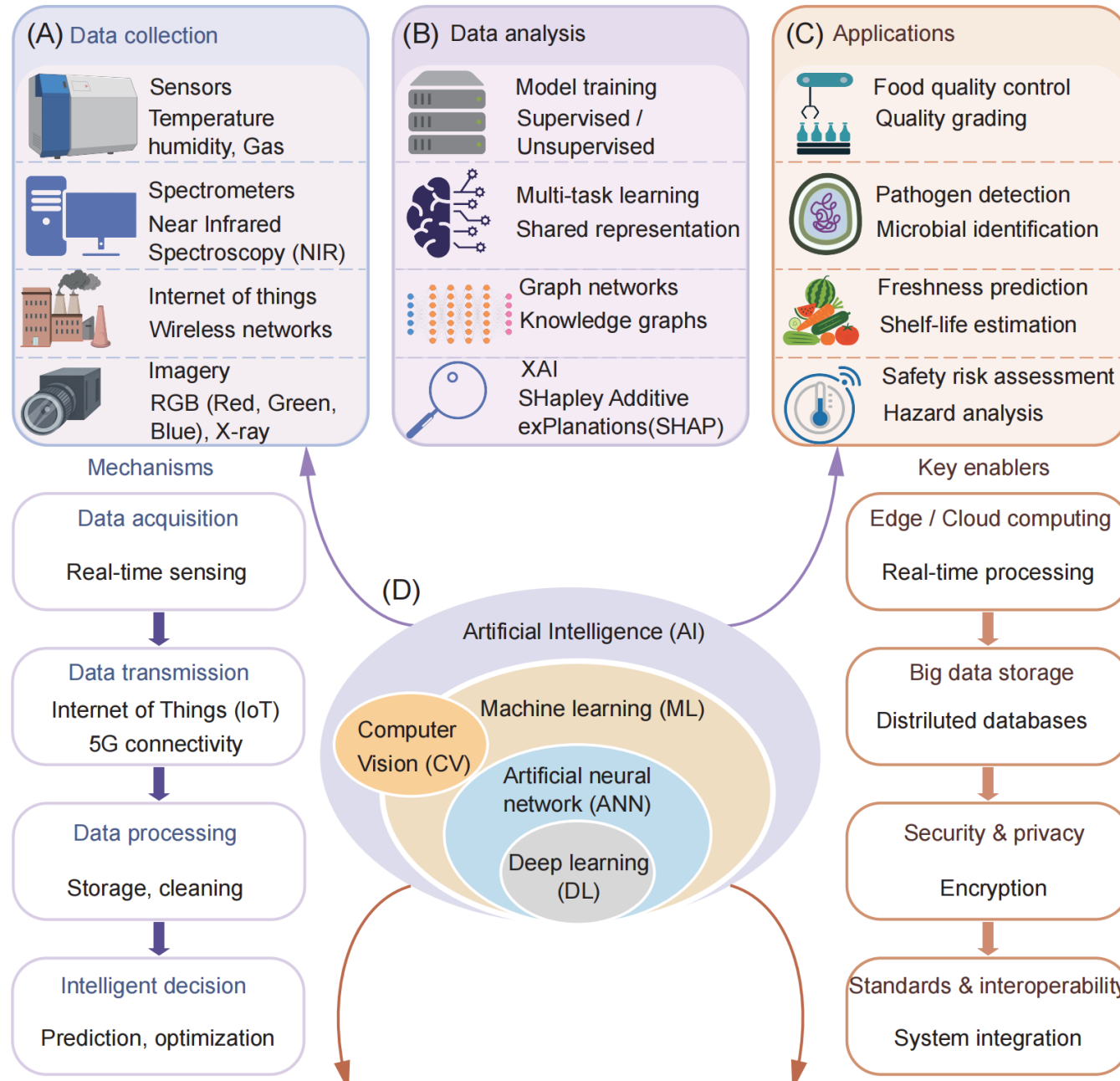


Figure 5 Applications of AI in livestock production within a One Health context.

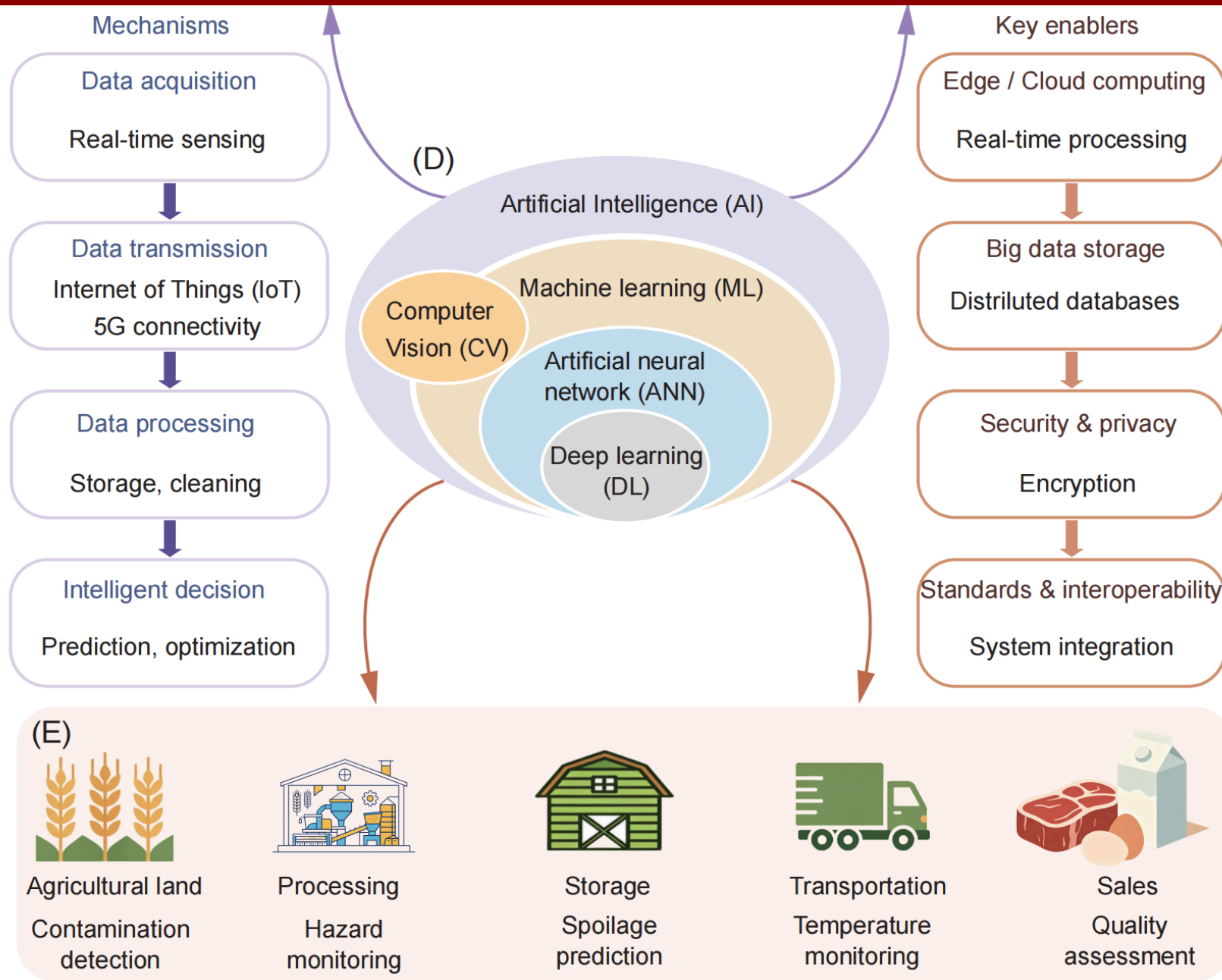


AI-enhanced intelligent monitoring of food safety



Applications of AI in food safety.

AI-enhanced intelligent monitoring of food safety



Applications of AI in food safety.



Conclusions and future perspectives

- ❑ In this study, we propose an AI-driven four-dimensional “diet–gut microbiota–host health” paradigm.
- ❑ We elucidate advances in AI-enabled deciphering of bidirectional diet–gut microbiota interactions, and evaluate the AI-driven design of precision nutritional interventions and their clinical translation.
- ❑ We critically analyze the inherent limitations of microbiome AI models and outline key challenges and future research directions.
- ❑ Future directions are focused on organoid models, spatial multi-omics, digital twins and multimodal deep learning to advance research into host health.

Tianle He, Shuobo Zhang, Jiaxin Chen, Xiaoling Zheng, Jixin Zhao, Huifeng Li, Jiani Mao, et al. 2026.
Artificial intelligence (AI)-driven diet-intestinal microbiota-host health integration: A four-dimensional paradigm for advancing host wellness research. *iMetaOmics* 3: e70133. <https://doi.org/10.1002/imo2.70133>



“***iMeta***” launched in 2022 by iMeta Science Society, **impact factor (IF) 44.4**, **ranking top 47/22643 in the world**. It aims to publish innovative and high-quality papers with broad and diverse audiences. Its scope is similar to *Cell*, *Nature* and *Science*. Its unique features include video abstract, bilingual publication, and social media with 800,000 followers. Indexed by [SCIE/ESI](#), [PubMed](#), [Google Scholar](#) etc.

“***iMetaOmics***” launched in 2024, indexed by [ESCI](#), [PubMed](#), [Google Scholar](#), with a **target IF>15**, and its scope is similar to *Nature Communications*, *Science Advances*, *Advanced Science*, *Nucleic Acids Research*, etc.

“***iMetaMed***” launched in 2025, with a target IF>15, similar to *Med*, *Cell Reports Medicine*, *eBioMedicine*, *eClinicalMedicine* etc.



Society: <http://www.imeta.science>

Publisher: <https://wileyonlinelibrary.com/journal/imeta>

iMeta: <https://wiley.atyponrex.com/journal/IMT2>

Submission: iMetaOmics: <https://wiley.atyponrex.com/journal/IMO2>

iMetaMed: <https://wiley.atyponrex.com/journal/IMM3>



[iMetaScience](#)



[iMetaScience](#)



office@imeta.science

imetaomics@imeta.science



[Promotion Video](#)

Update
2026/6/17