



Exposure to micro- and nano-plastics: From human internal burden to systems-level health-risk interpretation

Chen Tu¹, Jie Yang¹, Jingyi Liao², Rongkui Hu², Yudong Feng¹, Di Wu³, Yankai Xia³, Dan Wang¹, Jinrong Tang⁴, Xianzheng Yuan⁵, Dong Zhu⁶, Jing Wei⁷, Li Xu⁸, Mingkai Xu⁹, Xuetao Guo¹⁰, Jian Zhao¹¹, Qiqing Chen¹², Zhenming Zhang¹³, Lianzhen Li¹⁴, Yini Ma¹⁵, Xiaoxu Jiang¹⁶, Kai Zhang¹⁷, Cheng Peng¹⁸, Mengyao Li¹⁹, Ning Shen^{20, 21}, Willie J. G. M. Peijnenburg²², Matthias C. Rillig²³, Jason C. White²⁴, Yongming Luo^{1*}, Ningwei Zhao^{2, 21*}

¹State Key Laboratory of Soil and Sustainable Agriculture, Institute of Soil Science, Chinese Academy of Sciences, Nanjing, China

²Affiliated Hospital of Nanjing University of Chinese Medicine, Nanjing, China

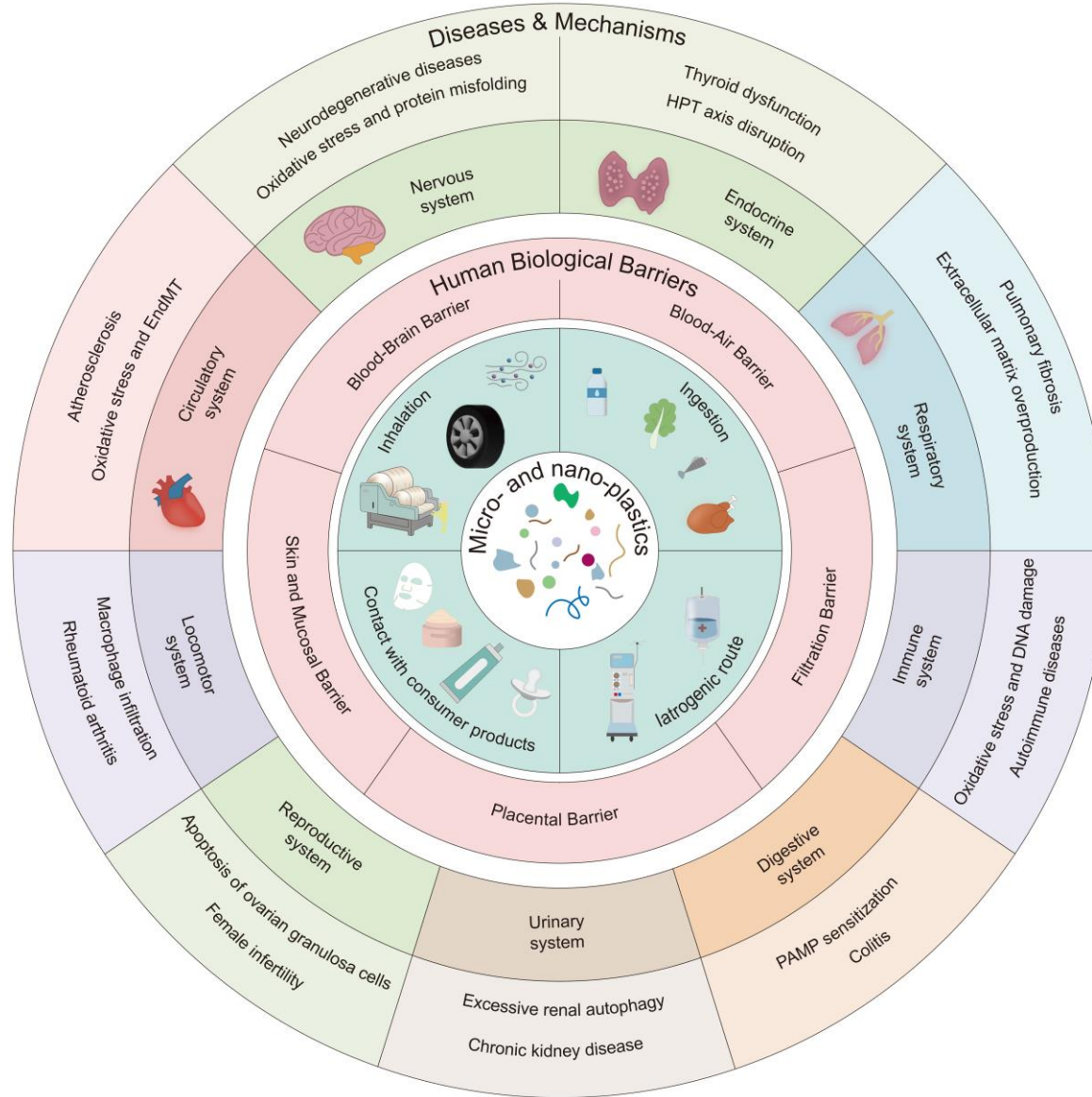


Chen Tu, Jie Yang, Jingyi Liao, Rongkui Hu, Yudong Feng, Di Wu, Yankai Xia, et al. 2026. Exposure to micro- and nano-plastics: From human internal burden to systems-level health-risk interpretation. *iMeta* 5: e70156.

<https://doi.org/10.1002/imt2.70156>.



Introduction





Highlights

- ❑ Micro - and nano - plastics (MNPs) can enter the human body through inhalation, ingestion, contact with consumer products, and iatrogenic routes.
- ❑ The heterogeneity of internal burden is shaped by four interrelated dimensions: particle characteristics, exposure context, host factors, and barrier integrity.
- ❑ The clinical relevance of MNP exposure should be interpreted at three levels: barrier interaction, cellular stress, and system-level disruption, with key mechanisms including oxidative stress, mitochondrial dysfunction, and chronic inflammation.



Routes of Human Exposure to MNPs

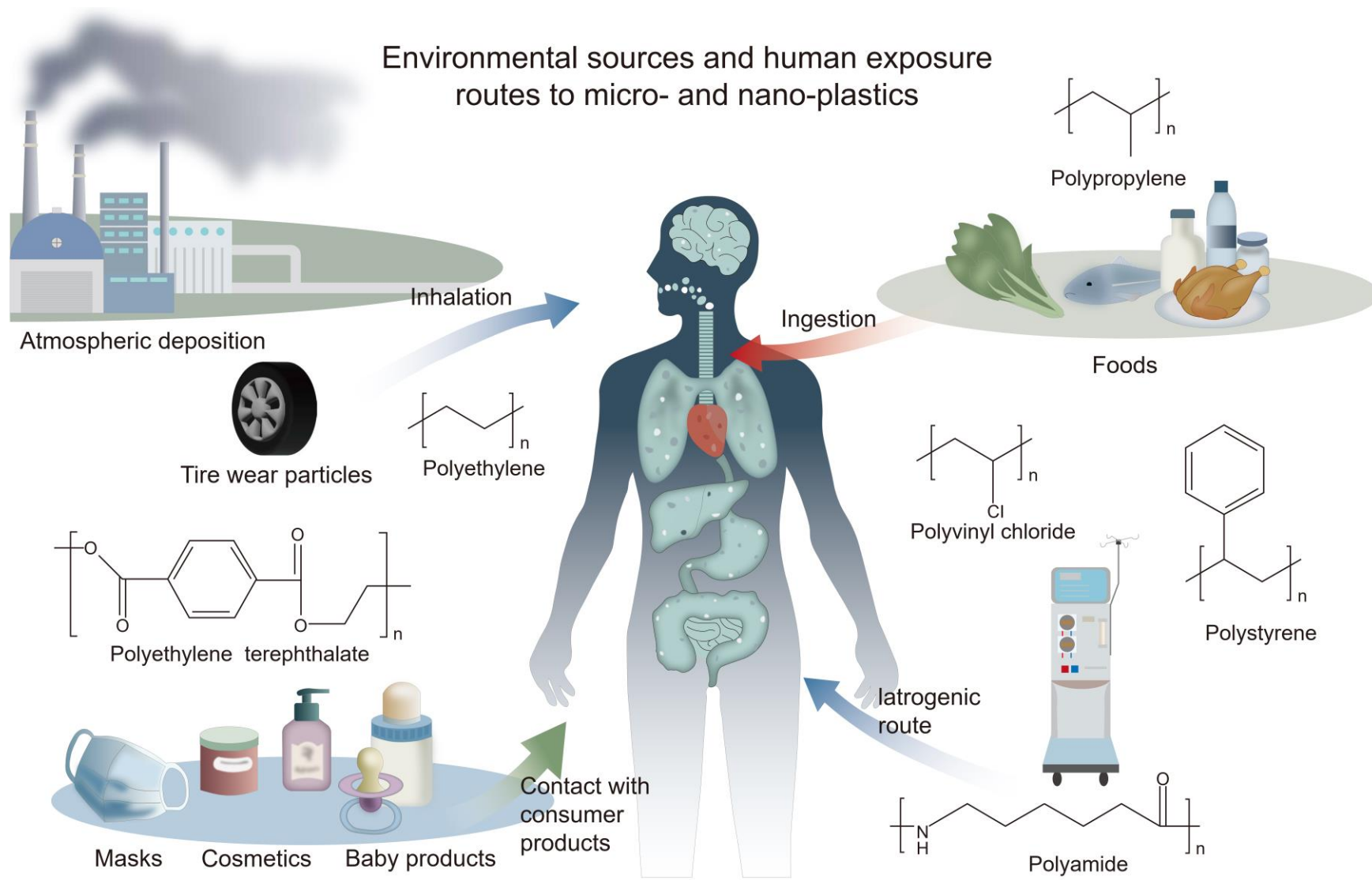


Figure 1 Environmental sources and human exposure routes to micro- and nano-plastics.

Internal Burden, Clinical Relevance, and Mechanistic Insights into MNP-induced Toxicity

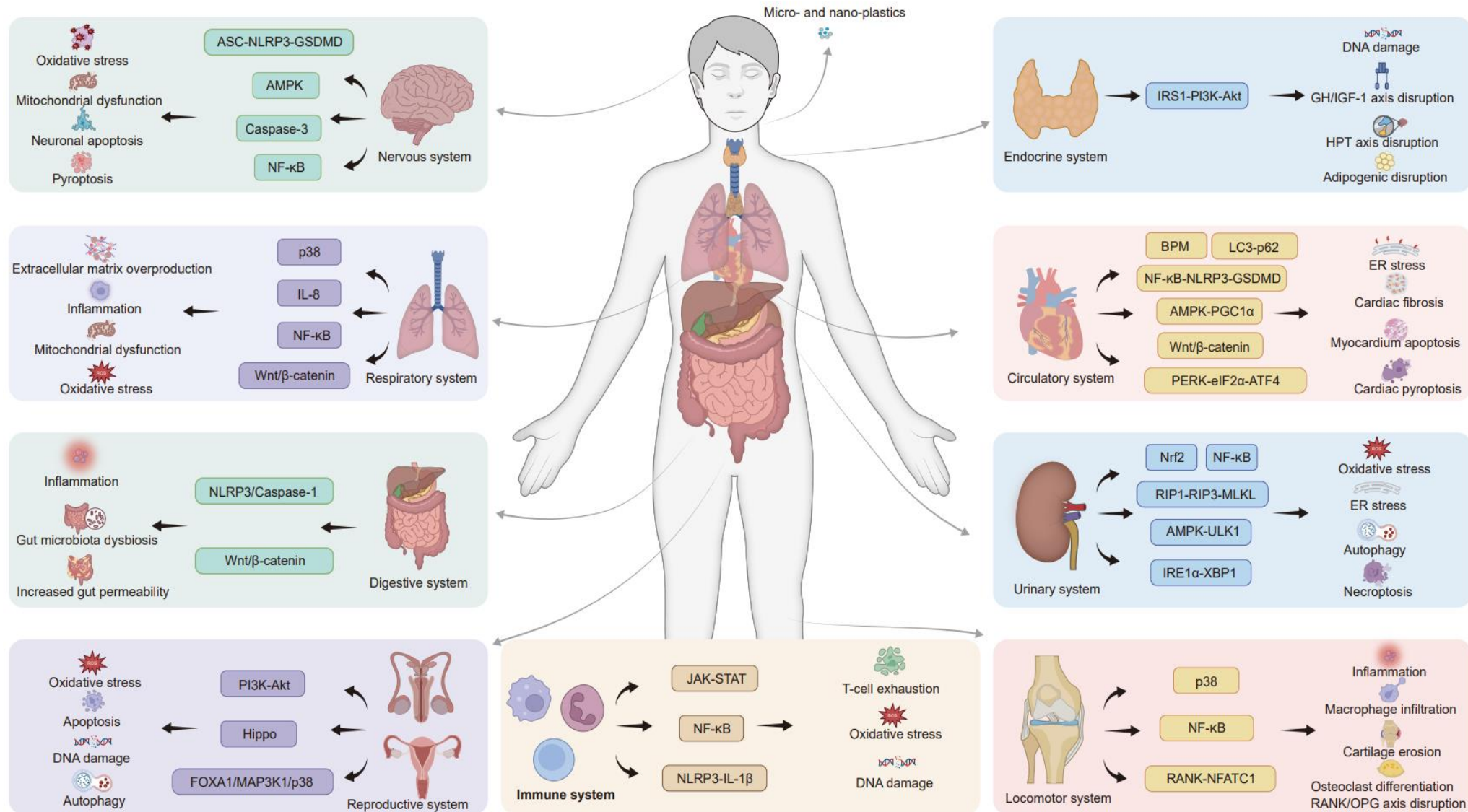


Figure 2 Disease risks and mechanisms of exposure to micro- and nano-plastics in human organ systems.

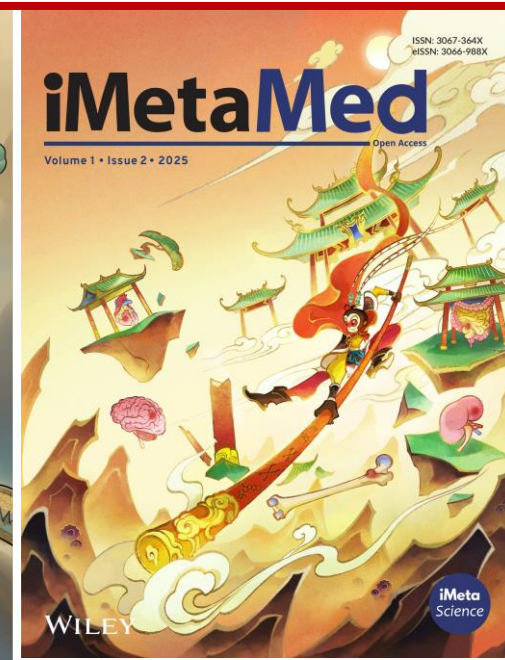
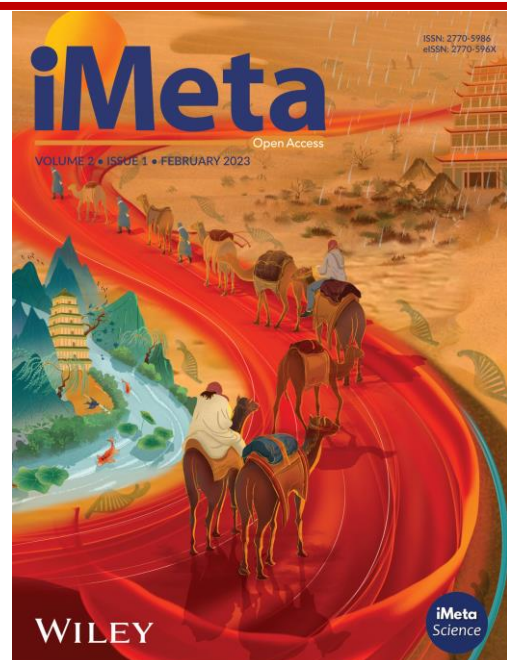


Future Directions

- ❑ In conclusion, MNP research has entered a stage in which human detection, internal burden, organ-specific distribution, and biological responses need to be interpreted through a systems-level framework.
- ❑ The field has moved beyond proof of presence, but direct causal inference in humans remains limited. The central challenge is now to determine which exposure conditions, internal-burden ranges, and microbiome–immune–metabolic networks are sufficient to make MNP exposure biologically and clinically significant.
- ❑ Addressing this challenge will require harmonized analytical methods, environmentally realistic exposure models, longitudinal human studies, quantitative exposure–effect modeling, and close integration of exposure science with clinically grounded systems biology.

Chen Tu, Jie Yang, Jingyi Liao, Rongkui Hu, Yudong Feng, Di Wu, Yankai Xia, et al. 2026. Exposure to micro- and nano-plastics: From human internal burden to systems-level health-risk interpretation. *iMeta* 5: e70156.

<https://doi.org/10.1002/imt2.70156>.



“**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