

DYSFUNCTION OF THE GUT MICROBIOTA IN LUCANIAN SUBJECTS EXPOSED TO DIFFERENT POLLUTANTS

Giovanna Canora¹, Emanuela Lavanga², Salvatore D'Angelo², Maria Grazia Bonomo²

¹Department of Basic and Applied Sciences, University of Basilicata

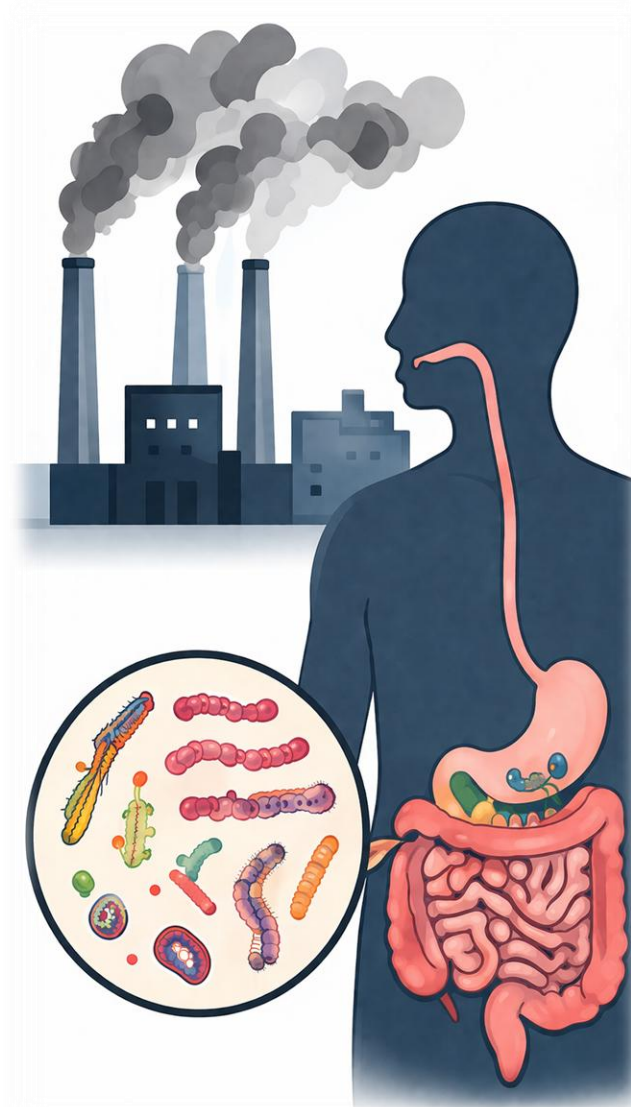
²⁻ⁿ Department of Health Sciences, University of Basilicata

INTRODUCTION

Environmental pollution is a major determinant of human health, responsible for some 9 million premature deaths each year worldwide¹. Chronic exposure to air pollutants, heavy metals, persistent organic pollutants and emerging contaminants is associated with increased risk of cardiovascular, respiratory, metabolic, neurodegenerative, and autoimmune diseases².

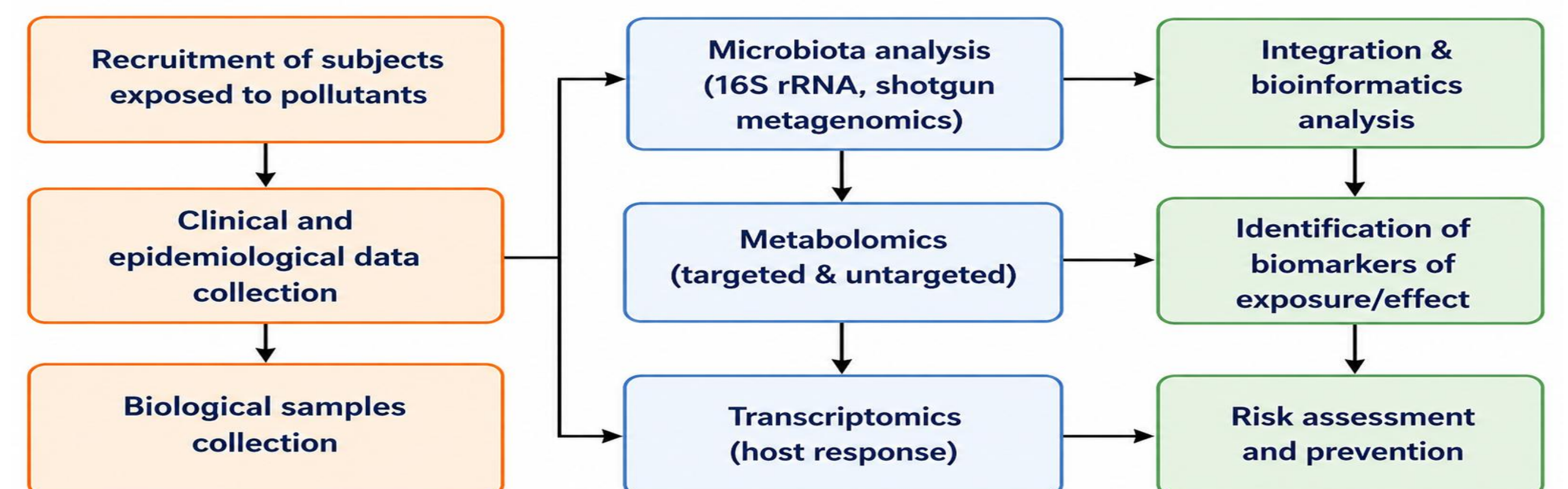
In this context, the gut microbiota has emerged as a possible mediator of environmental effects on the organism. The complex gut microbial ecosystem play a key role in maintaining gut homeostasis and modulating immune and metabolic functions. Dysbiosis induced by pollutant exposure may lead to impaired gut barrier, altered metabolism and chronic inflammation^{3,4}.

These alterations may represent key factors linking environmental exposure to the pathogenesis of immune-mediated diseases such as rheumatoid arthritis^{5,6}.



METHODS

The study will characterize gut microbiota in healthy subjects and patients with pathologies potentially associated with chronic exposure to environmental pollutants using epidemiological data. Microbial composition and function will be analyzed through DNA/RNA extraction and next-generation sequencing. Multi-omics approaches will be applied to investigate microbiota activity and response to environmental exposure.



RESULTS

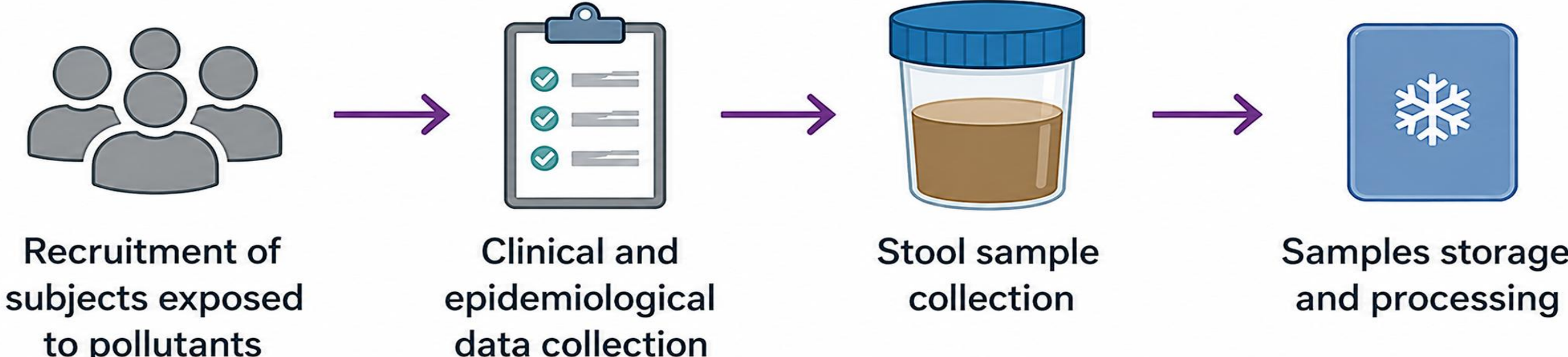
RECRUITMENT AND COLLECTION OF BIOLOGICAL SAMPLE

The study is currently in the recruitment phase. Adult participants (18–75 years) diagnosed with rheumatoid arthritis according to ACR/EULAR 2010 criteria (score ≥ 6) are being enrolled at the Rheumatology Unit of San Carlo Hospital (Potenza, Italy). Inclusion criteria include the ability to provide informed consent, residence in the study area, and no use of NSAIDs or antibiotics in the month prior to recruitment. Stool samples and associated clinical and epidemiological data are currently being collected from exposed subjects.

CURRENT STATUS

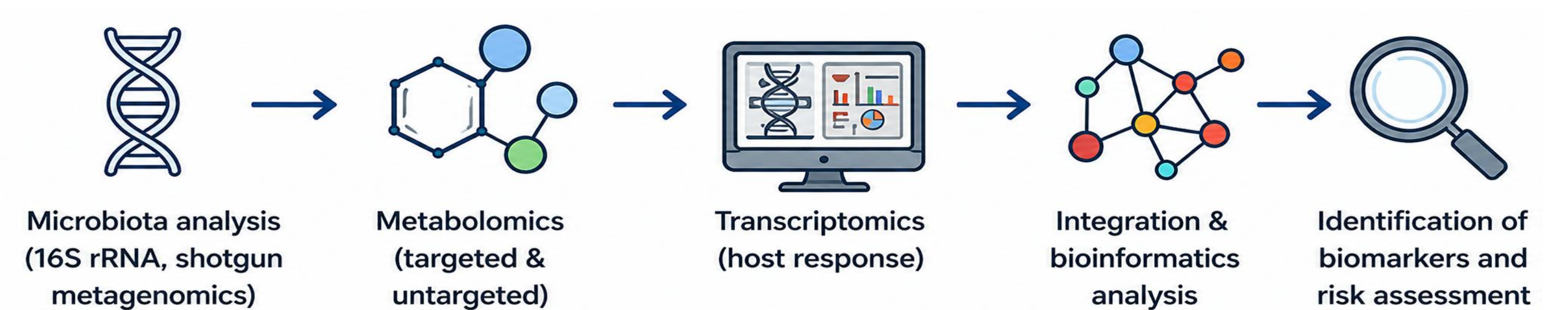
RECRUITMENT AND SAMPLE COLLECTION

Samples are transferred to the laboratory within 2 hours and stored at -20°C using standardized procedures to minimize contamination.

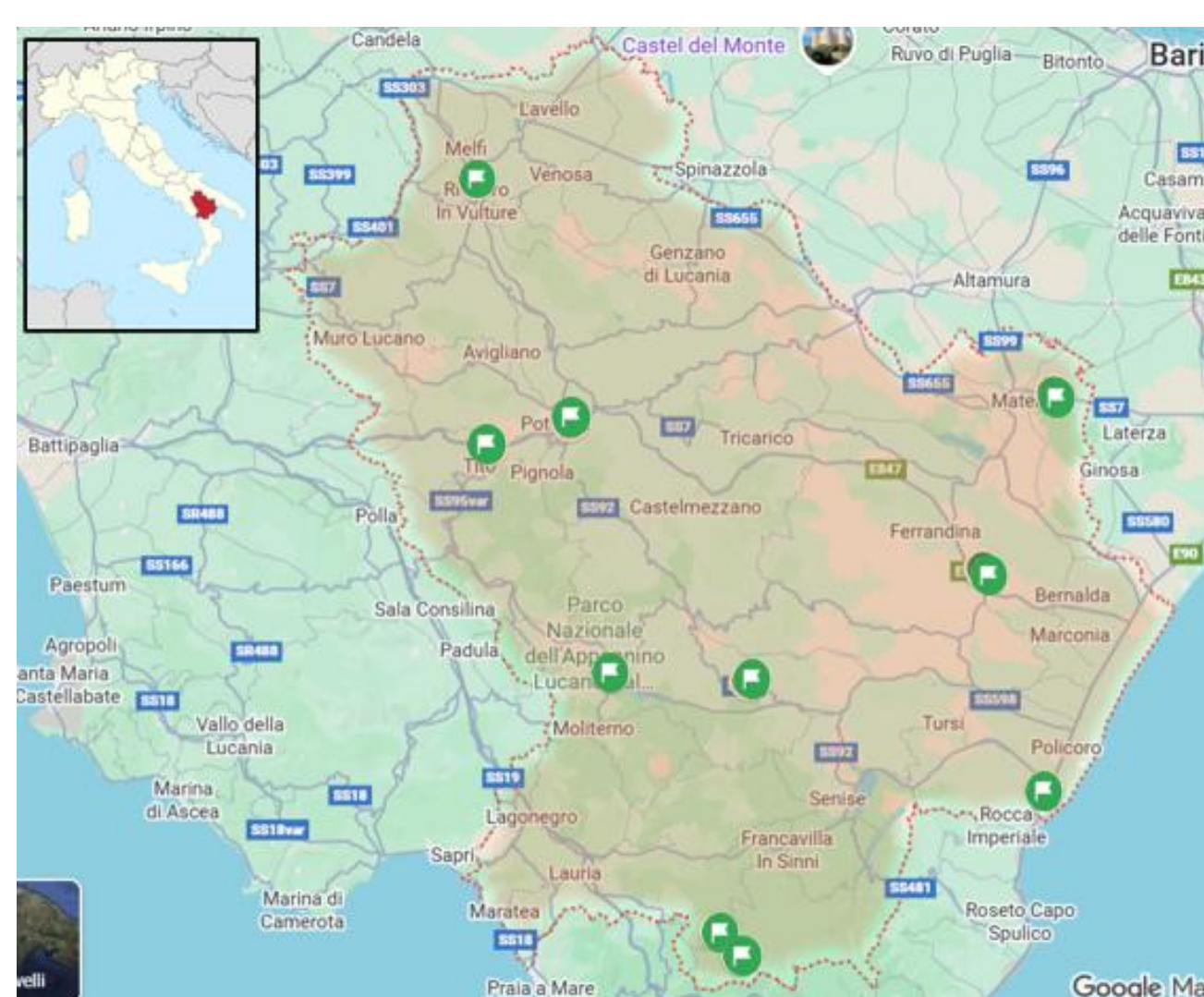


PLANNED NEXT STEPS

LABORATORY ANALYSES AND INTEGRATED APPROACH



1. STUDY AREA AND ENVIRONMENTAL EXPOSURE

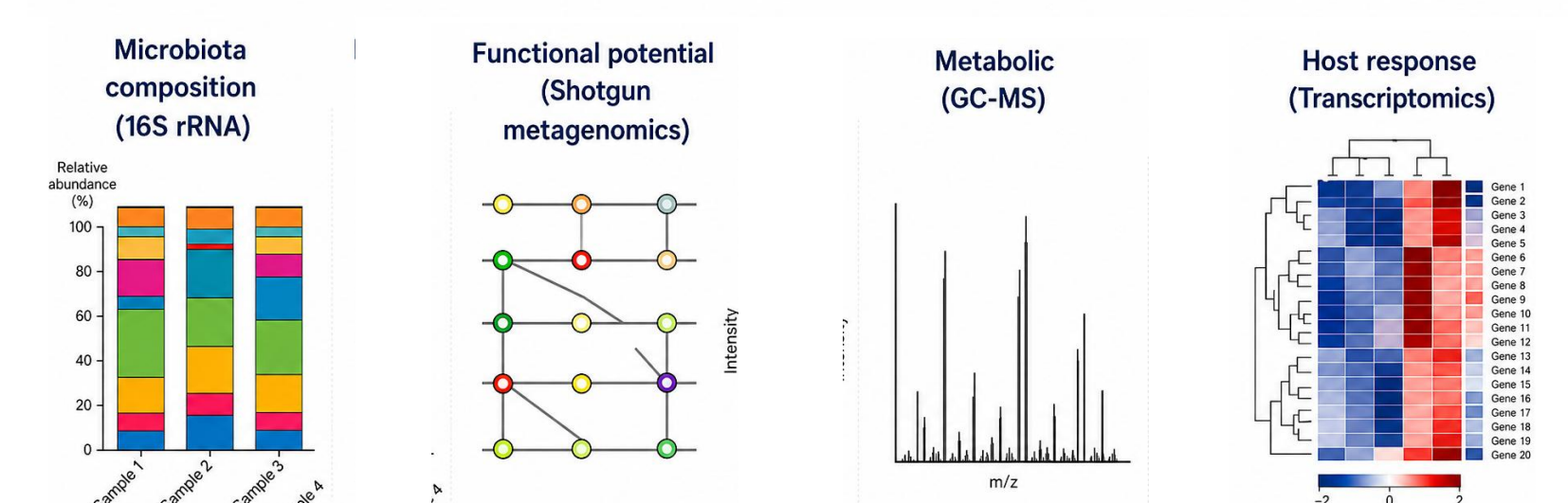
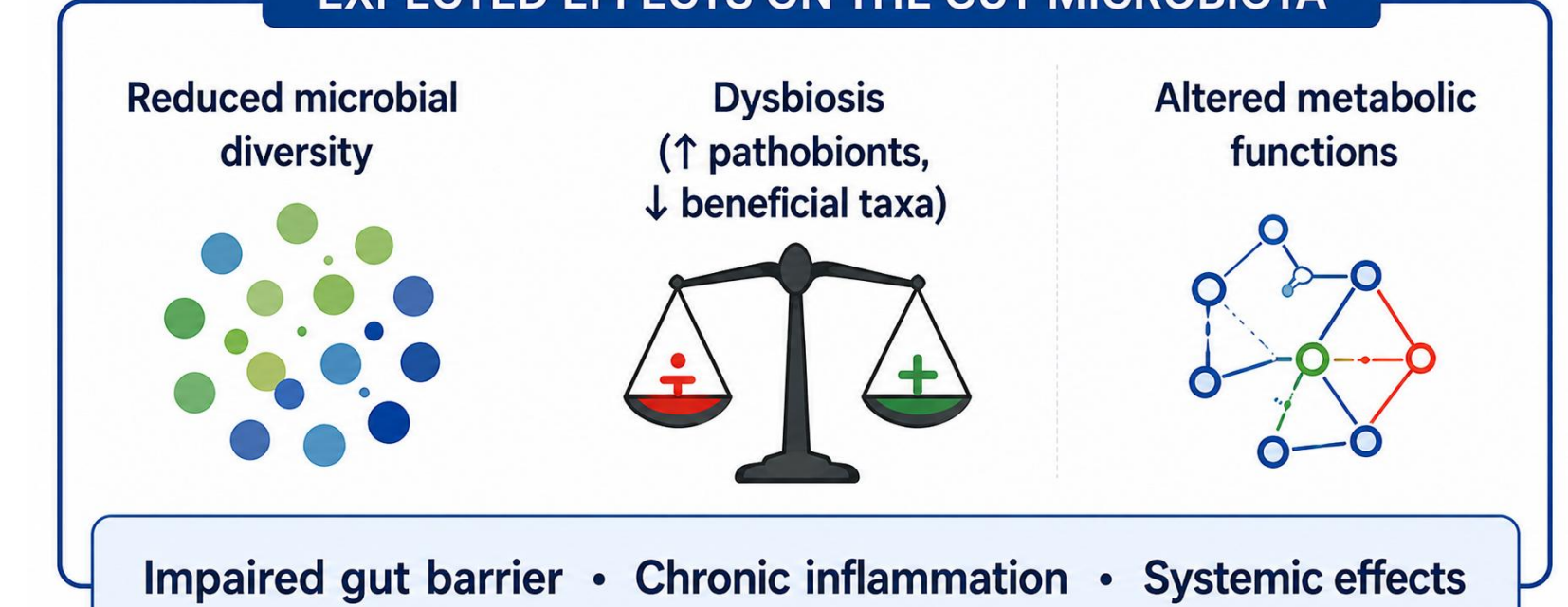


Some areas of the Basilicata region (Southern Italy) are characterized by different levels of environmental exposure to heavy metals, atmospheric particulate matter (including black carbon), and volatile organic compounds (VOCs).

SITE OF INTEREST	ENVIRONMENTAL ISSUES CURRENTLY IMPACTING HEALTH
SIN DI TITO SCALO	<ul style="list-style-type: none"> Presence of trichloroethylene in soil and water matrices. Air quality, with particular reference to VOCs and black carbon.
SIN Val Basento I	<ul style="list-style-type: none"> Presence and distribution of mercury in soils and subsoil. Presence and distribution of vinyl chloride in the area's groundwater. Asbestos risk related to the activities of the former Materit plant.
SIN Val Basento II	<ul style="list-style-type: none"> Study of water and soil matrices in the Tecnoparco-Val Basento area, with particular attention to contaminants typical of the hydrocarbon production chain. Odorous substances and VOCs.
VAL D'AGRI - COVA	<ul style="list-style-type: none"> Air quality, with particular attention to atmospheric particulate matter (black carbon and differentiation between natural and anthropogenic sources) and to contaminants typical of the hydrocarbon production chain.
VALLE DEL SAURO – TEMPA ROSSA	<ul style="list-style-type: none"> Air quality, with particular attention to atmospheric particulate matter (black carbon and differentiation between natural and anthropogenic sources) and to contaminants typical of the hydrocarbon production chain.
POLLINO – AREA NORD-OCCIDENTALE	<ul style="list-style-type: none"> Assessment of the risk from naturally occurring asbestos. Presence and distribution of heavy metals, with particular reference to hexavalent chromium, in surface and groundwater and in the soils of the area.
CENTRO ENEA-TRISAIA	<ul style="list-style-type: none"> Identification of environmental anomalies related to natural and anthropogenic radioactivity.
TERMOVALORIZZATORE RENDINA (ITM); CEMENTIFICIO BARILE E MATERA; FERRIERA DI POTENZA; VALLE DEL MERCURE	<ul style="list-style-type: none"> Air quality related to production sites.

2. EXPECTED RESULTS

EXPECTED EFFECTS ON THE GUT MICROBIOTA



INTEGRATION OF MULTI-OMICS DATA

- ✓ Correlation between microbial changes, metabolic pathways and gene expression
- ✓ Identification of microbial and metabolic biomarkers of exposure and effect

CONCLUSIONS

- ✓ Previous studies suggest that chronic exposure to environmental pollutants may be associated with alterations in gut microbiota, metabolic functions and host response.
- ✓ An integrated multi-omics approach will enable the identification of microbial, metabolic and molecular biomarkers of exposure and effect.
- ✓ These findings will support the role of the gut microbiota as a mediator between environmental pollution and human health, contributing to future preventive and personalized strategies.

PERSPECTIVES

- ✓ Validation of identified biomarkers in larger cohorts.
- ✓ Longitudinal studies to assess causality
- ✓ Development of microbiota-based interventions (probiotics, diet, prebiotics)
- ✓ Support for public health policies and environmental risk management

REFERENCES

- [1] Rio P., Gasbarrini A., Gambassi G., Cianci R. Pollutants, microbiota and immune system: Frenemies within the gut. *Front Public Health*. 2024;12:1285186.
- [2] Ma W., Xiong X., Tian Z., Li L., Huang Y. Environmental pollutants and the gut microbiota: Mechanistic links from exposure to systemic disease. *Front Microbiol*. 2026;17:1737229.
- [3] Campana M., Laue H.E., Shen Y., Shrubsole M.J., Baccarelli A.A. Assessing the role of the gut microbiome at the interface between environmental chemical exposures and human health: Current knowledge and challenges. *Environ Pollut*. 2022;315:120380.
- [4] Amarnani A., Silverman G.J. Understanding the roles of the microbiome in autoimmune rheumatic diseases. *Rheumatol Immunol Res*. 2023;4(4):177–187.
- [5] Taneja V. Gut microbes as the major drivers of rheumatoid arthritis: Our microbes are our fortune! *Microorganisms*. 2025;13(2):255.
- [6] Bonomo M.G., D'Angelo S., Picerno V., Carriero A., Salzano G. Recent advances in gut microbiota in psoriatic arthritis. *Nutrients*. 2025;17:1323.

ACKNOWLEDGEMENTS

