BiomeXplore: Integration of Gut Microbiota and Exposome Data for Health

BACKGROUND

The human **gut microbiota**, the dynamic community of bacteria, archaea, viruses, and fungi living in our gut plays a central role in maintaining our health state. There is an increasing interest in applying the microbiota study to the translational medicine. It is a real possibility nowadays to decipher its role as a complex **fingerprint of our lifetime exposures and a global health indicator**, but the **high-throughput exposure and microbiota** measurement produces **large, complex, and heterogeneous datasets** that are **difficult to analyze and interpret** for clinicians and those unfamiliar with microbiota research. **Predictive artificial intelligence** (AI) is emerging as a powerful tool to potentially uncover patterns within these data, integrate taxonomic, functional, and environmental information, and identify a **health-associated microbiome gut signature.**

BIOMEXPLORE & BIOM4HEALTH INDEX (B4H)

BiomeXplore is a massive data hub designed to evaluate the **health status** of a community of people based on their **gut microbiota and associated exposome**. As part of the **European Data spaces**, it is a structured environment that allows **secure, federated and interoperable data sharing**. BiomeXplore employs advanced AI models trained on **taxonomic and functional profiles** to classify samples and **differentiate between healthy and disease-associated gut microbiota.** To enable the integration of microbiota data as a health biomarker, we developed the **Biom4Health index (B4H)**, a health-disease indicator derived from taxonomic microbiota profiles and calculated through bioinformatic pipelines and machine-learning approaches.

A key component of BiomeXplore is the integration of a **georeferenced exposome** layer capturing both **external and internal determinants of health**, including diet, lifestyle, environmental pollution, weather conditions, and socioeconomic factors.

This multidimensional framework enables **a holistic interpretation of health** data and supports integrated analyses for the **design, implementation, and long-term evaluation of preventive strategies** tailored to specific populations and regions.

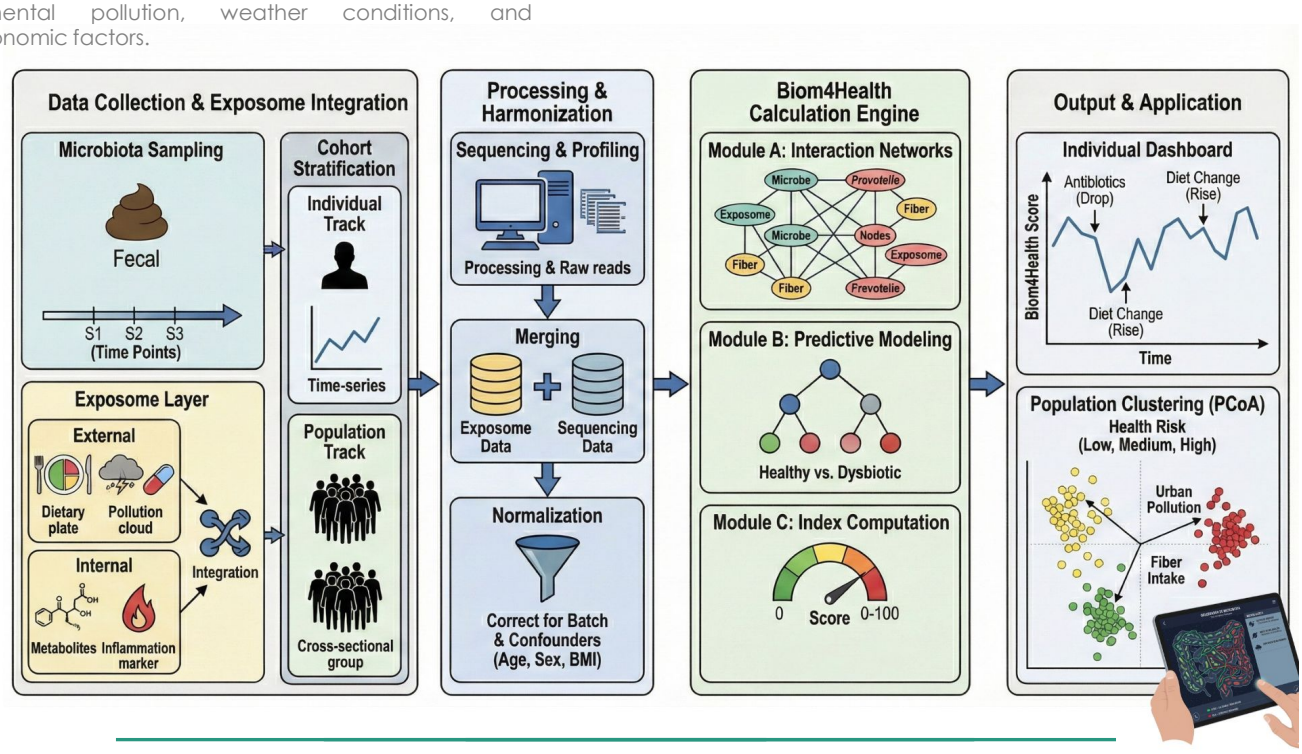
RESOURCES

BiomeXplore brings together a dynamic team **of microbiologists, bioinformaticians, and AI engineers** with extensive experience in microbiome science and data-driven health research.
Biomexplore's core components include:

- Fecal **sample processing and high-throughput sequencing.**
- **Full-spectrum fecal microbiota analysis.**
- Calculation of the **Biome4Health Index** as a population health indicator.
- **Synthetic microbiota fastq repositories.**
- Integrated **exposome** identification and modeling.
- Structured **questionnaires for exposome data acquisition**.
- **A secure, interoperable data space enabling governed data sharing and reuse.**

COLLABORATION OFFER

We are interested in establishing collaborations with **companies focused on the clinical validation of probiotics and prebiotics** aimed at improving microbiota well-being, as well as with partners conducting **clinical trials to advance in the mechanistic understanding of disease** processes linked to the gut microbiota. In addition, we seek to collaborate with **technology companies developing wearable devices or digital health solutions**, and with partners interested in the **generation, integration, and exploitation of exposomic data** to support preventive, predictive, and personalized health strategies within a **One Health** framework.



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