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MRGM: A Comprehensive Catalog of Mouse Gut Microbial Genomes Expanding Taxonomic Diversity and Functional Insight

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Research on the mouse gut microbiome is essential for advancing our understanding of the human gut microbiome, offering valuable insights into disease mechanisms, host-microbe interactions, and the effects of diet on microbial communities. To improve the translational relevance of these studies, detailed and high-quality catalogs of mouse gut microbial genomes are necessary. Here, we present the Mouse Reference Gut Microbiome (MRGM), a comprehensive catalog containing 42,245 non-redundant bacterial genomes from the mouse gut, representing 1,524 species. This catalog expands the known taxonomic diversity of mouse gut microbes by 40%, capturing previously underrepresented microbial lineages through advanced genome quality assessment methods. MRGM not only enriches the taxonomic diversity of the mouse gut microbiome but also enhances its functional landscape. Using deep learning, we have significantly improved the Gene Ontology annotation rate for mouse gut microbial proteins, increasing the rate from 3.2% to 60%—an over 18-fold improvement. MRGM enables both DNA- and marker-based taxonomic profiling, outperforming previous catalogs in accuracy and versatility. Comparative analyses between human and mouse gut microbiota reveal notable diet-driven differences in both taxonomic composition and functional enrichment. Overall, our work underscores the importance of high-quality microbial genome catalogs for advancing our understanding of gut microbiome evolution and its interaction with the host.