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Modeling the Impact of Breast Milk Components on the Infant Gut Microbiome

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Abstract:

Breast milk ideally represents the sole source of nutrition for infants during the first months of life, yet the mechanisms by which it shapes the infant gut microbiome and health during this critical developmental window remain understudied. This talk explores the complex nature of maternal breast milk and how its components impact the developing infant gut microbiome through the integration of dietary information, metagenomics, metabolomics, and exposomics data. Results show that the maternal breast milk microbiome is diverse and dominated by bifidobacteria, with strains shared between breast milk and the infant gut spanning both commensal taxa and pathobionts. Antimicrobial resistance genes detected in mothers' breast milk overlap with those found in their infants' gut, highlighting breast milk as a potential source of antimicrobial resistance acquisition. Integration of milk metabolomics data further reveals associations between breast milk metabolites, maternal dietary habits, and specific microbial taxa in the infant gut. Finally, pilot data on environmental contaminants present in breast milk, such as PFAS, show that these highly persistent compounds are associated with maternal diet, milk metabolites, and infant gut microbiome composition.