

CEIPEX MENDELU 2

Položka / Field	Obsah / Content
CEIPEX Research Topic Level2	Molecular microbiology
Název výzkumné skupiny	Mikrobiologie
Téma	Beyond Resistance: Decoding the Hidden Functions of Plasmids in Bacterial Pathogens
Anotace k tématu	Plasmids are key drivers of bacterial evolution and major vehicles of antimicrobial resistance (AMR), yet their biological impact extends far beyond resistance gene carriage. They encode diverse accessory functions affecting bacterial metabolism, stress responses, persistence, virulence and adaptation, while many plasmid-borne genes remain functionally unexplored. Moreover, particular plasmids form remarkably stable associations with specific bacterial lineages, suggesting that their evolutionary success depends on functional compatibility and co-adaptation with their bacterial hosts. Understanding what makes such associations successful and what plasmids provide to bacterial pathogens beyond resistance represents a major unresolved question. This research topic explores the molecular and evolutionary basis of successful plasmid–host associations in clinically relevant bacteria, particularly Enterobacterales. Both AMR and non-AMR plasmids provide complementary models for investigating how plasmid-encoded functions influence bacterial physiology, fitness and adaptation, and how these effects contribute to plasmid persistence and pathogen success. Particular attention may be given to conserved and poorly characterized plasmid genes and proteins that could provide previously unrecognized adaptive functions. The topic offers an interdisciplinary framework connecting plasmid genomics, computational and structural biology, molecular microbiology, systems biology and molecular medicine. Long-read sequencing and comparative genomics can reveal complete plasmid architectures and conserved plasmid–host associations, while advanced computational approaches, including AI-based protein structure and function prediction, can uncover candidate functions hidden within the plasmid accessory genome. Their molecular and physiological roles can be investigated using targeted genetic and biochemical approaches and complemented by high-resolution omics. Importantly, selected plasmid-encoded functions can be explored in advanced mammalian cellular or organoid models to determine whether plasmids influence host recognition, inflammatory responses or other aspects of host–pathogen interaction. By moving beyond resistance, this research area aims to uncover the molecular functions that make particular plasmid–host associations evolutionarily successful and to reveal how plasmids contribute to bacterial adaptation, persistence and pathogenicity at the interface between microbial evolution and host biology.
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