Student Speech Contest 2025

Metabolomics-Inspired Bioceramic: Amorphous Calcium Phosphate with Glutamate Targeted Metabolic Enhancement for Bone Repair

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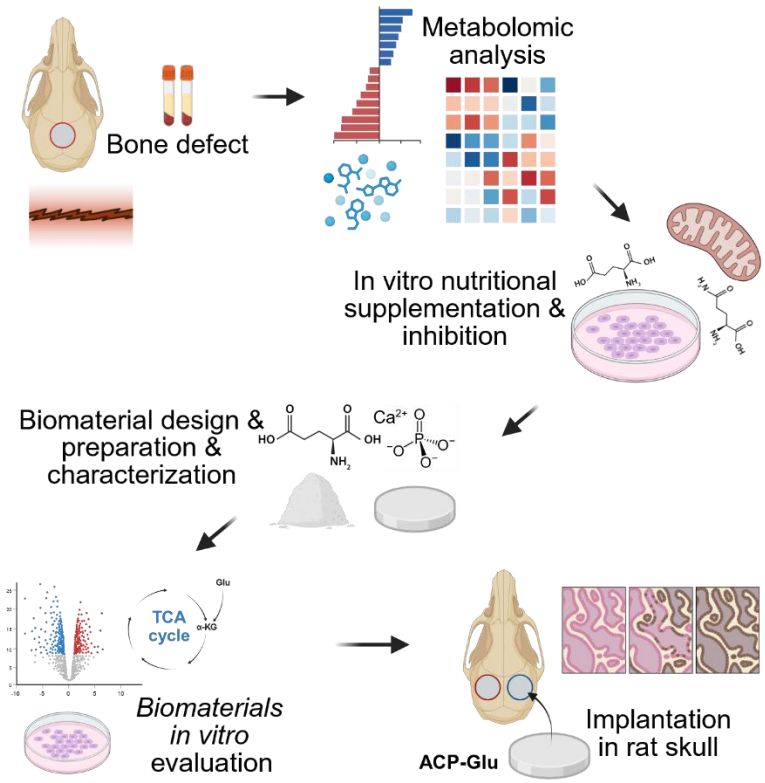
Topic/keyword: Metabolomics, glutamate, amorphous calcium phosphate.

Abstract.



This study leverages in vivo metabolomic profiling to identify biochemical bottlenecks in bone healing, translating these data-driven insights directly into the design of a precision bioactive ceramic. By covalently anchoring glutamate into an amorphous calcium phosphate framework (ACP-Glu), we stabilize the amorphous state and enable the sustained, linear release of metabolites that synchronize with the host's metabolic demands. This integrated approach effectively rescues TCA cycle flux and accelerates mineralized tissue formation, establishing a new paradigm for "bio-informed" materials that respond to real-time physiological cues.