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Abstract Text
The advancement in the domain of Engineered Living Materials (ELMs) utilizing fungal cells marks a significant paradigm shift in materials science. This cutting-edge research explores the use of mycelium, the vegetative network of filamentous fungi, to engineer sophisticated functional materials. Mycelium inherently exhibits unique properties such as self-assembly, environmental responsiveness, and intrinsic self-healing capabilities, which are central to the development of fungal-based ELMs. This study introduces a novel approach in the synthesis of pure mycelium materials, demonstrating their potential as sustainable alternatives to traditional leather. The first objective is to elucidate the underlying biological mechanisms and key parameters that govern the regeneration process in fungal ELMs. A crucial breakthrough of this research is the identification of chlamydospores—robust, thick-walled cells formed at the end of hyphae—as key contributors to the self-repair mechanisms in these materials. The second objective explores the viability of mycelium as a functional material, especially post-production. Our findings indicate that these mycelium-based materials exhibit exceptional resilience, capable of enduring extreme conditions such as desiccation and nutrient scarcity, while retaining the capacity for repair within a 48-hour timeframe. Finally, the study aims to quantitatively assess the self-healing efficiency of these materials. This includes a comprehensive analysis of the time required for healing and a detailed characterization of the mechanical and physical properties pre- and post-damage and healing. The research seeks to determine the extent to which these materials can recover their original structural integrity and functionality after undergoing damage and the timeframe for such recovery.