Researchers develop piezocatalytically-induced controllable mineralization scaffold with bone-like microenvironment

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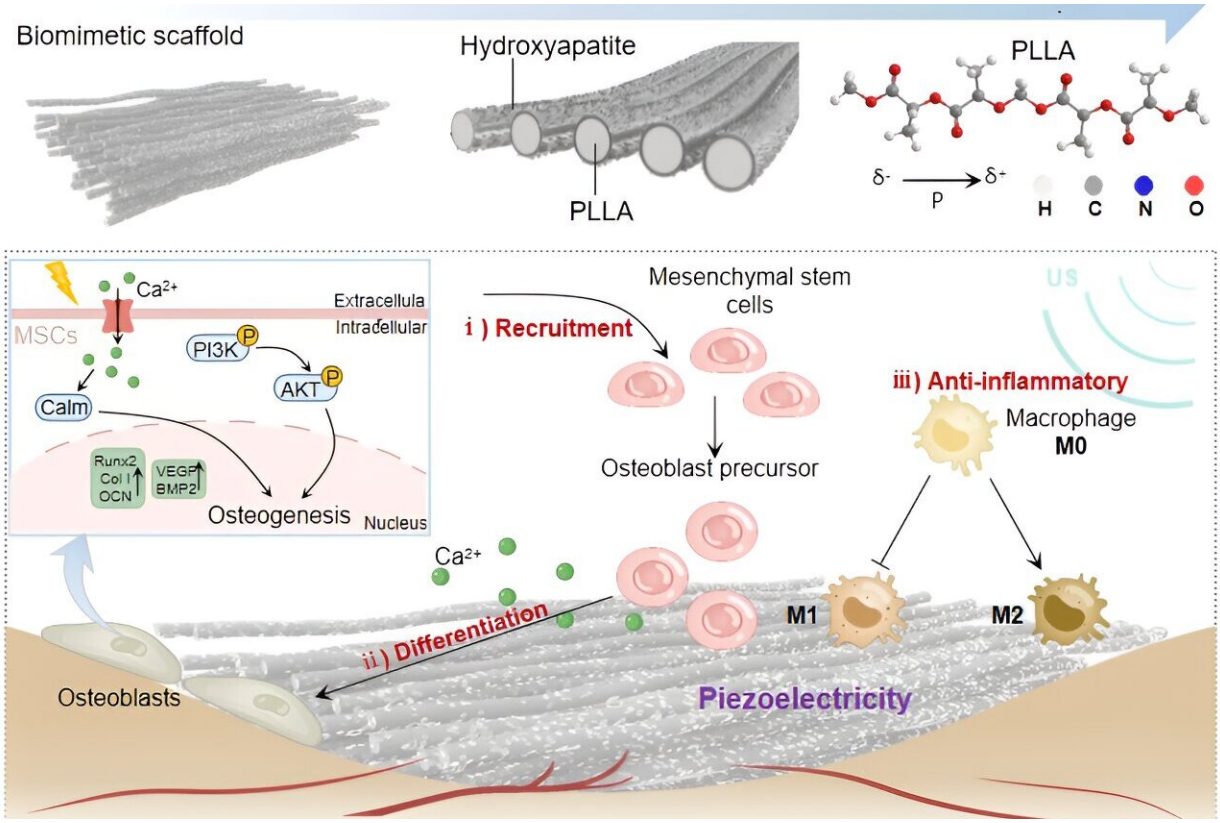

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Inspired by nature, the researchers developed a piezocatalytically-induced controlled mineralization strategy using piezoelectric polymer

poly-L-lactic acid (PLLA) fibers with ordered micro-nano structures to prepare biomimetic tissue engineering scaffolds with a bone-like microenvironment (pcm-PLLA), in which PLLA-mediated piezoelectric catalysis promoted the in-situ polymerization of dopamine and subsequently regulated the controllable growth of hydroxyapatite crystals on the fiber surface.

Their study is published in the journal *Science Bulletin*.

PLLA fibers, as analogs of mineralized collagen fibers, were arranged in an oriented manner, and ultimately formed a bone-like interconnected pore structure; in addition, they also provided bone-like piezoelectric properties. The uniformly sized HA nanocrystals formed by controlled mineralization provided a bone-like mechanical strength and chemical environment.

The pcm-PLLA scaffold could rapidly recruit endogenous stem cells, and promote their osteogenic differentiation by activating cell membrane calcium channels and PI3K signaling pathways through ultrasound-responsive piezoelectric signals. In addition, the scaffold also provided a suitable microenvironment to promote macrophage M2 polarization and angiogenesis, thereby enhancing bone regeneration in skull defects of rats.

The proposed multifaceted bionic natural bone strategy provides a new idea for the development of bone tissue engineering scaffolds.

The research team was led by Dr. Zhou Li (Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences) and Chunying Chen (National Center for Nanoscience and Technology).

More information: Xi Cui et al, Piezocatalytically-induced controllable mineralization scaffold with bone-like microenvironment to achieve endogenous bone regeneration, *Science Bulletin* (2024). DOI: 10.1016/j.scib.2024.04.002

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