



Editorial

Cell metabolism and bone cells



Bioenergetic metabolism plays a pivotal role in cell survival, proliferation and differentiation, particularly in the context of glycolysis and oxidative phosphorylation, but cell metabolism extends beyond ATP production and involves the accumulation of ROS and intermediate metabolites that contribute to epigenetic modifications and biosynthetic pathways (Shyh-Chang et al., 2013). The aim of this Special Issue is to advance our current understanding of the role of cell metabolism in the skeletal system. The following sections will review how various nutrients modulate the metabolism of skeletal cells, delve into biosynthesis, epigenetics, oxidative stress and mitochondrial respiration, explore how hormones such as parathyroid hormone (PTH) impact the energy metabolism of bone cells, and ultimately present insights into the metabolic demands of malignant cells within the bone environment.

Eliseev and colleagues offer a comprehensive analysis of current knowledge concerning cell energy metabolism in bone tissue, highlighting the most significant changes observed during aging and other pathologies (Sautchuk Jr. and Eliseev, 2022).

Stegen and colleagues discuss amino acid metabolism in skeletal cells, emphasizing its role in fueling essential cellular functions beyond protein synthesis. The article summarizes recent research elucidating how amino acid metabolism supports and regulates skeletal cell function throughout bone growth, homeostasis, and disease. Notably, glutamine emerges as a critical player, significantly impacting osteoblast and chondrocyte function and differentiation, driven by lineage-specific transcription factors and osteoanabolic agents (Devignes et al., 2022).

Long explores the relationship between glucose metabolism and bone cells. The author delves into the delicate balance between bone resorption and formation, crucial for maintaining bone mass and structure. He highlights the energy-intensive activities of osteoclasts and osteoblasts in these processes, shedding light on the evolving understanding of skeletal cell metabolism over the past decade. The review synthesizes current knowledge of glucose metabolism in chondrocytes, osteoblasts, and osteoclasts, emphasizing the potential for new avenues in bone therapies (Long, 2022).

Schipani and colleagues delve into mitochondrial respiration and its significance in bone cells. The authors provide insights into the energetic pathways, detailing the interplay between glycolysis and oxidative phosphorylation in undifferentiated mesenchymal progenitors, differentiating osteoblasts and osteoclasts. They also discuss the multifaceted outcomes of cell metabolism, including the generation of ROS and intermediate metabolites, which influence various cellular functions and epigenetic modifications (Sabini et al., 2023).

Guntur and colleagues focus on the modulation of cell energy metabolism by PTH in bone cells. They illuminate PTH's role in regulating glucose, fatty acid, and amino acid metabolism, highlighting the

metabolic flexibility of osteoblasts in response to substrate availability. Through their research on MC3T3E1C4 calvarial pre-osteoblasts, they demonstrate that PTH stimulation leads to increased glycolysis and oxidative phosphorylation, contingent on substrate presence. This study provides valuable insights into the energetic demands of osteoblasts under the influence of PTH (DeMambro et al., 2023).

Lastly, Van Gestel and colleagues concentrate on the bone marrow microenvironment's complex cellular composition and its importance in both physiological and pathological contexts. They emphasize the intricate intercellular communication necessary for proper skeletal and hematopoietic tissue function, which can be disrupted when malignancies infiltrate the bone marrow niche. The authors discuss the emerging role of metabolic crosstalk among various cell types in this setting, shedding light on a new dimension of intercellular communication (Tirado et al., 2023).

This Special Issue underscores the integral role of cell metabolism in skeletal cell differentiation, function, and pathology. The review articles collectively provide a comprehensive view of how nutrient metabolism, oxidative stress, mitochondrial respiration, hormones, and metabolic crosstalk shape the bone microenvironment. As the field continues to evolve, these insights hold promise for innovative approaches in bone-related therapies and interventions.

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