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The temporospatial pattern of energy metabolism coordinates the interactions between the bones and other organ systems

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Abstract

Background

Bones adapt to loads by changing their structure. This biomechanical interaction and the formation/maintenance of bones are orchestrated by three major cell types residing in the bones: osteoblasts, osteocytes, and osteoclasts. Recent findings suggest that, in addition to their biomechanical interactions, bones and other organ systems may also communicate biochemically.

Highlight

This brief review will discuss the interaction between the bones and the nervous system, vasculature, muscle, and fat tissues, with an emphasis on the role of the energy metabolism in these interactions.

Conclusion

Studies on the connections between bones and other organ systems indicate the possible existence of a temporospatial pattern of energy metabolism through the cellular biorhythm and migration.

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Abbreviations

Cx43, connexin43; FGF23, fibroblast growth factor 23; PTH, parathyroid hormone; BMD, bone mineral density; RANKL, receptor activator of nuclear factor kappa-B ligand; HSPC, hematopoietic stem/progenitor cell; G-CSF, granulocyte colony-stimulating factor; SDF-1, stromal derived factor-1; β2AR, beta 2-adrenergic receptor; *Gja1*, gene of connexin43; cKO^{col1}, 2.3-kb *Col1a1* promoter knock out mouse model; glu-OC, undercarboxylated osteocalcin; Runx2, runt-related transcription factor 2; GDF11, growth differentiation factor 11; RI, repeat interval; HHO, Havers-Halberg oscillation; *Clock*, Circadian Locomotor Output Cycles Kaput; *PDIA3*, protein disulfide isomerase family A member 3; GJIC, gap junctional intercellular communication; BRC, Bone remodeling compartment

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