

Direct cell–cell contact between mature osteoblasts and osteoclasts dynamically controls their functions in vivo.

Keywords: imaging, osteoclast, osteoblast, pharmacology

Bone homeostasis is regulated by communication between bone-forming mature osteoblasts (mOBs) and bone-resorptive mature osteoclasts (mOCs). However, the spatial–temporal relationship and mode of interaction in vivo remain elusive.

The research group of Masaru Ishii and Junichi Kikuta (Immunology and Cell Biology, IFRc & Graduate School of Medicine, Osaka University) showed, by using an intravital imaging technique, that mOB and mOC functions are regulated via direct cell–cell contact between these cell types. The mOBs and mOCs mainly occupy discrete territories in the steady state, although direct cell–cell contact is detected in spatiotemporally limited areas. In addition, a pH-sensing fluorescence probe reveals that mOCs secrete protons for bone resorption when they are not in contact with mOBs, whereas mOCs contacting mOBs are non-resorptive, suggesting that mOBs can inhibit bone resorption by direct contact. Intermittent administration of parathyroid hormone causes bone anabolic effects, which lead to a mixed distribution of mOBs and mOCs, and increase cell–cell contact. This study reveals spatiotemporal intercellular interactions between mOBs and mOCs affecting bone homeostasis in vivo.

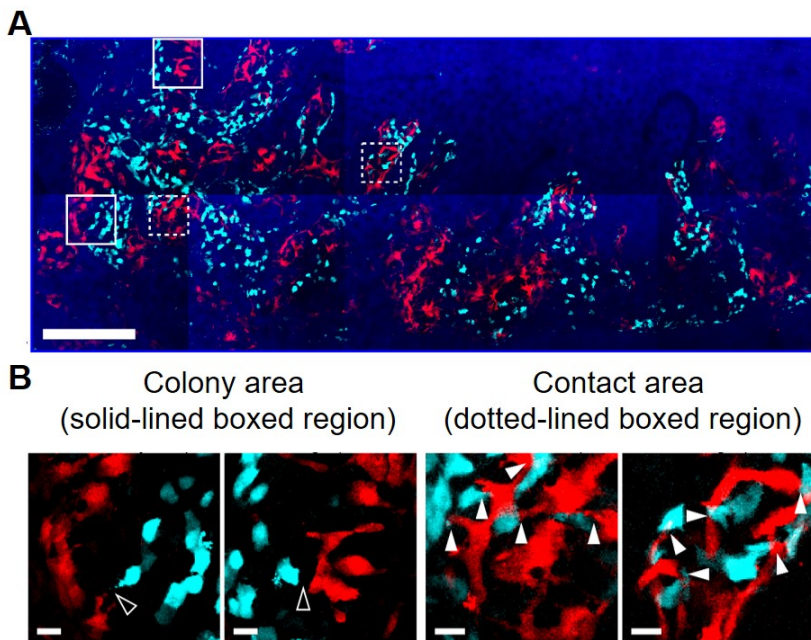


Fig.1 Simultaneous visualization of mOBs and mOCs in living bones using intravital two-photon microscopy. (A) A Tiling image of skull bone tissues. Cyan, mOBs; red, mOCs; blue, bone tissues. Scale bar, 300 μ m. (B) Magnified images of colony region (left panels) and contact area (right panels). Open arrowheads, separated mOBs and mOCs; filled arrowheads, direct mOB–mOC contact. Scale bar, 20 μ m. (Osaka University)

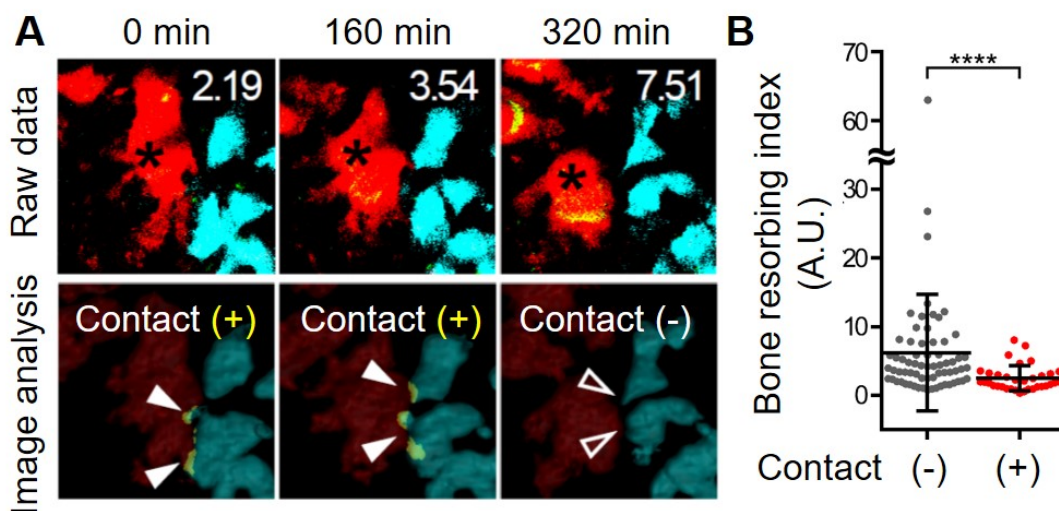


Fig.2 Direct contact with mOBs inhibits the bone-resorbing activity of mOCs. (A) Images of bone-resorptive activity in skull bone tissues using a pH-sensing chemical probe. Green, pH probe; Cyan, mOBs; red, mOCs; yellow, contact areas; filled arrowheads, areas of mOB–mOC contact; open arrowheads, separated mOBs and mOCs. The actual values of bone-resorbing index (BRI) are shown to the right of the images. (B) Assessment of BRI of mOCs in contact, or not, with mOBs. (Osaka University)

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Authors: Masayuki Furuya, Junichi Kikuta, Sayumi Fujimori, Shigeto Seno, Hiroki Maeda, Mai Shirazaki, Maki Uenaka, Hiroki Mizuno, Yoriko Iwamoto, Akito Morimoto, Kunihiko Hashimoto, Takeshi Ito, Yukihiro Isogai, Masafumi Kashii, Takashi Kaito, Shinsuke Ohba, Ung-il Chung, Alexander C. Lichtler, Kazuya Kikuchi, Hideo Matsuda, Hideki Yoshikawa and Masaru Ishii

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