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News on current events in osteoporosis and rheumatology

Primary cilia mediate mechanosensing in bone cells

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Bone alters its morphology and density in response to external loads. Lack of mechanical stimulation has been linked to bone loss in osteoporosis. Models of bone tissue predict that during loading, fluid flows through the compartments (lacunae) that house osteocytes within mineralized bone and through the channels (canaliculae) that connect lacunae to each other and to bone-forming osteoblasts at the bone surface. Experiments in cultured bone cells have shown that dynamic fluid flow stimulates osteogenic, and inhibits bone resorptive, responses. Primary cilia are solitary, immotile, microtubule-based organelles that grow from the centrosome and project from the cell surface in many vertebrate tissues, including bone. Primary cilia also function as flow sensors in kidney tubule epithelial cells where they mediate calcium entry through polycystin 2, a stretch-activated calcium channel. Mutations of polycystins cause polycystic kidney disease.

A recent study [1] evidences that osteoblasts and osteocytes possess primary cilia with physical characteristics consistent with a flow-sensing function. These primary cilia are required for osteogenic and bone resorptive responses to dynamic fluid flow. Unlike in kidney cells, primary cilia in bone translate fluid flow into cellular responses in bone cells independently of calcium flux and stretch-activated ion channels.

These results suggest that primary cilia might regulate bone homeostasis. Identification of a mechanism for mechanotransduction in bone could lead to therapeutic approaches for combating bone loss due to osteoporosis.

1. Malone AMD et al. *Prac Natl Acad Sci USA*. 2007;104:13325-13330.

Primary cilia mediate mechanosensing in bone cells

Osteoblasts and osteocytes are equiped with primary cilia which are solitary, immotile, microtubule-based organelles that grow from the centrosome and project from the cell surface. Through primary cilia, these cells can sense fluid flow. In response to flow, primary cilia bend and are able to transduce this mechanical signal into cellular response. In response to fluid flow, the osteoprotegerin over RANK ligand ratio increases, thereby reducing bone resorption.

Identification of this mechanism for mechano-transduction in bone could lead to therapeutic approaches for combating bone loss due to osteoporosis.