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Editorial

Osteocyte

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EDITORIAL NOTE

A cell found within the substance of fully formed bone is called an osteoclast. It lives in a small chamber known as a lacuna within the calcified matrix of bone. Osteocytes are derived from osteoblasts, or bone-forming cells, and are essentially osteoblasts encased in the released products. In tiny canaliculi, the osteocyte's cytoplasmic processes expand away from the cell and toward neighbouring osteocytes. The osteocyte's survival is maintained through the exchange of nutrients and waste products through these canaliculi. In mature bone tissue, osteocytes are the most common cell type. They're also long-lived; lasting as long as the bone they're in is still alive. The osteocyte has the ability to deposit and resorb bone. It also helps with bone remodelling by sending signals to other osteocytes in response to even minor bone deformations caused by muscle action. In this way, bone develops stronger when it is subjected to more stress (for example, through frequent exercise or physical exertion) and weaker when it is not. When the body's calcium level falls too low, the osteocyte may help remove calcium from bone. Diseases like osteoporosis and osteoarthritis are linked to the premature death or malfunction of osteocytes.

Osteocytes have a stellate shape with a depth of 7 micrometres, a width of 15 micrometres, and a length of 15 micrometres. The cell body has a diameter of 5 micrometres -20 micrometres and contains 40 cell-60 cell processes per cell, with a cell-to-cell spacing of 20 micrometres -30 micrometres. A mature osteocyte has a single nucleus with one or two nucleoli and a membranous nucleus that is positioned toward the vascular side. In circumferential lamellae, the cell also has a smaller endoplasmic reticulum, Golgi apparatus, and mitochondria, as well as cell processes that radiate primarily towards the bone surfaces, or towards a haversian canal and outer cement line typical of osteons in concentric lamellar bone.

After a bone fracture, glutamate transporters in osteocytes create nerve growth factors, indicating the presence of a sensing and information transfer mechanism. The bones demonstrated a significant increase in bone resorption, decreased bone production, trabecular bone loss, and loss of sensitivity to unloading when osteocytes were experimentally eliminated. Osteocytes are mechanosensor cells that regulate the activity of osteoblasts and osteoclasts inside a Basic Multicellular Unit (BMU), a transient anatomic structure where bone remodelling takes place. Osteocytes provide an inhibitory signal that is transmitted to osteoblasts via their cell processes, allowing them to be recruited for bone production. Sclerostin, as well as other molecules like PHEX, DMP-1, MEPE, and FGF-23, which are extensively expressed by osteocytes and control phosphate and bio-mineralization, have been found to have a role in mineral metabolism. The osteocyte is a critical endocrine regulator of phosphate metabolism and a key regulator of bone mass.

Sclerostin is a secreted protein produced by osteoclasts that suppresses bone formation by binding to LRP5/LRP6 receptors and suppressing Wnt signalling. Sclerostin is the first mediator of communication between osteocytes, bone-forming osteoblasts, and bone-resorbing osteoclasts, and is essential for bone remodelling. Mechanical stress and Parathyroid Hormone (PTH) both suppress sclerostin. Sclerostin inhibits the function of BMP (bone morphogenetic protein), a cytokine that promotes the development of bone and cartilage.

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