



## Distribution of Type I Collagen Morphologies in Bone: Relation to Estrogen Depletion

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### Abstract:

Bone is an amazing material evolved by nature to elegantly balance structural and metabolic needs in the body. Bone health is an integral part of overall health, but our lack of understanding of the ultrastructure of healthy bone precludes us from knowing how disease may impact nanoscale properties in this biological material. Here, we show that quantitative assessments of a distribution of Type I collagen fibril morphologies can be made using atomic force microscopy (AFM). We demonstrate that normal bone contains a distribution of collagen fibril morphologies and that changes in this distribution can be directly related to disease state. Specifically, by monitoring changes in the collagen fibril distribution of sham-operated and estrogen-depleted sheep, we have shown the ability to detect estrogen-deficiency-induced changes in Type I collagen in bone. This discovery provides new insight into the ultrastructure of bone as a tissue and the role of material structure in bone disease. The observation offers the possibility of a much-needed in vitro procedure to complement the current methods used to diagnose osteoporosis and other bone disease.

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