

## **Mechanical and Biologic Influences on Bone Formation, Repair and Adaptation**

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It is well known that bone has the capacity to respond to alterations in applied physical forces. The ability of bone to respond to these forces depends on the manner in which the forces are transmitted through its hierarchical structure until eventually perceived by the sensor cells. As a result, the character of the mechanical signals received by the cells is dictated by the mechanical and biochemical properties of the hierarchical medium through which the signals are transduced. It follows, therefore, that research focused on characterizing the response of bone to mechanical signals is critically dependent on knowledge of the mechanical properties of the bone tissue within the framework of its hierarchical organization. The behavior of bone cells within these structures are, in turn, regulated by the expression of specific patterns of growth factors, cytokines and related biomolecules. The local production of these factors is significantly influenced by either mechanical events or metabolic pathways.

Results from a series of studies designed to characterize the mechanical and biologic properties of bone will be presented. The influence of physical forces on the development of bone, as well as repair and regeneration, will be reported as documented from a group of novel *in vivo* and *in vitro* experiments. The discussion will range from exploring the influence of hierarchical structures on fragility, to basic mechanisms controlling bone metabolism and the design of treatment strategies for chronic or acute disorders.