



Workshop Abstract

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The skeleton's tissue level response to mechanical demands

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The causes of many disorders not due to injury, cancer or infection are at the tissue level. Biologists separate anatomy, pathology and physiology according to the levels of biologic organisation. They speak of cell, tissue and organ levels, of organ systems and of the intact subject. The tissue level includes the physiology between cells through to organs, which takes part in organ function, properties, health and disorders including all the mechanisms, activities and functions that exist or arise in the tissue.

The most primary function of bone is to bear the mechanical load of everyday movement with subsidiary functions in plasma calcium homeostasis and supporting hematopoiesis. This paradigm has emerged from studies of the morphology and dynamics of bone cells and tissue modelling and remodelling, microdamage and biomechanical influence on bone adaptation. In simple biomechanical terms a bone will fracture if the load applied exceeds its strength.

Currently, it is clear that physiological strain continually produces fatigue induced microdamage in bone. This damage weakens bone and is associated with both the activation of remodelling and osteocyte apoptosis. Remodelling is the only known means by which this damage can be removed and repaired.

Bone is able to sense and adapt to its mechanical environment. The biological adaptive machinery includes modelling-dependent bone gain, remodelling-dependent bone loss and the detection of effective strain thresholds necessary to activate bone modelling or remodelling. Finally, changes in bone microstructure and geometry interact with each other in determining the overall tissue level mechanical properties.