

## Invited Speaker Abstract

ISI2

### **Skeletal adaptations during growth: insights from animal models**

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Animal studies illustrate greater structural adaptation of growing bone to exercise than adult bones, but not the training regimes to optimise bone strength in children. Controlled loading studies in animal bones have revealed mechanisms of mechanotransduction and loading characteristics that optimise modelling response to applied strains. Insights from these models reveal that static loads do not play a role in mechanotransduction, and that bone formation is threshold-driven and dependent on strain rate, amplitude and partitioning of the load. That is, only a few cycles of loading are required at any time to elicit an adaptive response, and that distributed bouts of loading, incorporating rest periods, are more osteogenic than single sessions of long duration. These parameters of loading have been translated into feasible public health interventions that exploit the insights gained from animal experiments to achieve adaptive responses in children and adolescents. Studies manipulating estrogen receptors (ER) in mice also demonstrate that skeletal sensitivity to loading during the peripubertal period is due to a direct regulation of mechanotransduction pathways by ER, and not just a simple enhancement of cell activity already marshaled by the hypothalamic-pituitary axis. Unfortunately, because the rate and timing of growth in small animals is completely different to that in humans, these models can be poor tools to elucidate periods during growth in youths during which the skeleton is more sensitive to loading. But, surprisingly, insights from studies of human growth can improve the interpretation of data from studies of growth and development in animals.