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Force-induced Bone Adaptation:

A Systems Biology Perspective
Towards Therapy Design

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Abstract

In this work, the author employs a systems biology approach to get a system-level understanding of the biological mechanisms driving the adaptive response of bone to increased/decreased mechanical loads. To this end, a mathematical model describing the adaptation of bone due to mechanical and chemical stimuli is developed and qualitatively validated. Novel set-based methods are employed to analyze the steady state effects of parameter uncertainty and robustness of the model. Furthermore, these set-based methods are used to explore the design of new treatments combining the beneficial effects of mechanical and non-mechanical agents for specific bone disorder conditions.