A Mathematical Model of the Bone Remodeling Process

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The bone remodeling process maintains the structure and function of the skeletal system. Understanding interruptions in this process can give insight on why bone diseases exist, how they can be prevented, and what therapies may help overcome such diseases. Mathematical models of bone cell populations have been influential in discovering the organization of the bone multicellular units (BMU) which is an integral part of the bone remodeling process. However, there are currently very few cell-population models that include external mechanical stimulus and microdamage, and their effect on the activation of BMU [1].

In this work, a spatio-temporal model is constructed to study the natural initiation of cortical BMU. The new model extends an existing mathematical model [2] by including the role of osteocytes and lining cells in sensing mechanical stress and microdamage, as well as in communicating with each other and other cells. Numerical simulations are performed to compare the model predictions to available data in the scientific literature.

References

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