

## **Multiscale modelling in the knee: Macro scale errors influence cell level bone remodelling predictions**

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This study presents a multiscale model of the knee joint developed as part of the international IUPS Physiome Project. A macro level finite element knee model is used to pass down strains to a meso, micro and finally a cell level model. The macro to micro level models are solved using finite elements in the bioengineering package CMISS ([www.cmiss.org](http://www.cmiss.org)) and the cell level model is integrated as a series of ODE's into the markup language CellML. This study explores the range of input errors encountered from motion capture and x-ray fluoroscopy; assumed boundary conditions; muscle force insertions/origins and magnitudes; and material property estimates. We then evaluate how they influence the trends and confidence of predictions at the cell level. A key conclusion from this study is that increased sub levels between macro and cell level models minimises the error propagated by acting as a check point against further microstructural information.

**Keywords:** Multiscale model; knee mechanics; bone remodelling; cell level mechanics