

Large Scale Computational Modelling of Cellular Biosystems  
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We develop a novel large scale parallel computational model allowing 3-D simulations of cell colonies growing and interacting with variable environment in previously unavailable tissue scale. The cells are modelled as individual objects located in the lattice-free 3-D space. The model incorporates cellular environment modelled in a continuous manner, mathematical description based on partial differential equations is formulated for selected important components of the environment. Discrete and continuous formulations are efficiently coupled in one model and allow considerations on different scales: sub-cellular, cellular and tissue scale. High parallel scalability allows simulation of up to  $10^9$  individual cells. This large scale computational approach allows for simulations to be carried out over realistic spatial scales up to  $1\text{cm}^3$  in size i.e. the tissue scale. For the first time a single model bridges the gap between intracellular dynamics and the tissue.