TSim, a Platform for Simulation of Multi-cellular Systems

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The simulation of intra-cellular processes such as metabolic networks or gene expression control mechanisms has been widely covered in many tools available today[1,2] however the simulation of multiple cells interacting in a common environment such as tissues is not yet fully available.

Tsim (Tissue Simulator) was initially developed for the study of early growth of tumours inspired on works previously done in the area[3] but unlike these studies, the simulation process in Tsim happens both inside and outside the cells.

Tsim works with a grid of slots that can represent empty spaces, blood vessels, cells of different kinds and other representations yet to be imagined. Each of these slots contains a state vector that defines both the type of the entity represented by the slot and the properties of these entities. For instance, for the simulation of tumour growth the state vector variables used were pH, pO2 and Glucose concentration in the extra-cellular environment as in literature. However in order to test the response of the cells to hypoxia and compare the efficiency of anaerobic versus aerobic glycolysis, this model was extended to include part of glycolytic kinetic equations available from other studies[4].

Future developments of Tsim should include support to SBML as well as multi-processing for quicker simulation of bigger systems. Beta versions of Tsim can be downloaded at no charges at http://www.i-genics.com.

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4. Westermark P et al. A Model of Phosphofructokinase and Glycolytic Oscillations in the pancreatic beta-cell. *Biophysical Journal* **85,** 126-139 (2003).