A model of atrial propagation based on *in vitro* action potential records

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Mathematical models have played an important role in the development of electrophysiology. However there is a need for experiment-specific models. Towards this aim a single-cell ionic model is described, able to reproduce a variety of cardiac action potential (AP) waveforms. The model consists of three ionic currents, two active and one leakage. Each active conductance moves between two states, a process that is controlled by a set s ability to reproduce experimental records, intracellular
of voltage-dependent rates. To test the modelâAPs were obtained from *in vitro* rabbit sino-atrial preparations using glass microelectrodes (N=3 cells). Spontaneous APs were recorded from central, peripheral sinus node (SN) and atrial cells. The sinus node APs had a slow depolarisation (pacemaker) phase which was absent in atrial cells. A numerical algorithm was developed to fit the model to a sequence of APs from each cell type. By searching for and using different sets of model parameters, the model is optimised to reproduce the characteristic AP waveforms of central, peripheral SN and atrial cells. The generic nature of the model allows it to be used to simulate electrical activation of heterogeneous tissue. A 3D simulation of atrial electrophysiology is also described using the NIH male Visible Human Dataset atrial geometry with our SN and atrial ionic models assigned to their respective regions. The SN was spontaneously active and able to excite the surrounding atrium replicating normal propagation. The methodology developed in this study allows ionic cell models to be fitted to experimentally recorded data and utilised in anatomically detailed simulations.