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Parameter Estimation of O'Hara Model for Arrhythmia Modeling Using Genetic Algorithms and Particle Swarm Optimization

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The mathematical representation of action potential and calcium transient in healthy human ventricular cells is encapsulated by the O'Hara model. This research centers on optimizing the parameters of the O'Hara model for arrhythmia modeling, using genetic algorithms (GAs) and Particle Swarm Optimization (PSO) for this purpose. Within the genetic algorithm and particle swarm population, individuals are characterized by continuous parameters, namely the maximum conductance of specific ion channels, time constants, and other relevant physiological parameters. These parameters include the maximum conductance of sodium (GNa), potassium (GK), and calcium (GCaL) channels, as well as time constants associated with various processes in the O'Hara model. The fitness function is designed to measure the disparity between the action potential associated with arrhythmia and that generated by the O'Hara model using parameters optimized through the genetic algorithm and particle swarm optimization. The results underscore the effectiveness of our proposed method in determining the O'Hara model's parameters for accurate arrhythmia modeling, utilizing both genetic algorithms and particle swarm optimization. This research has the potential to provide a deeper understanding of arrhythmia mechanisms, paving the way for innovative treatments in the future.

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