CORNELL Biomedical Sciences

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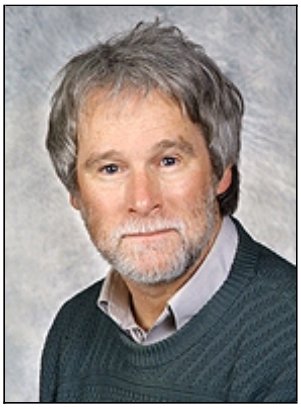

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MAJOR RESEARCH INTERESTS

The primary goal of our research is to identify the underlying cellular mechanisms for lethal heart rhythm disorders. Our approach to this problem involves both computer modeling and experimental studies. Simple dynamical models and more complex ionic models are used to study cellular electrical dynamics in single cardiac myocytes and in one-, two- and three-dimensional recreations of cardiac tissue. The models have been developed using data generated by voltage clamp studies of single canine ventricular myocytes and by experiments conducted in isolated Purkinje fibers, arterially perfused canine ventricle and intact dogs. Predictions made by the computer models are tested experimentally and the resulting data are used to further refine the models. Currently, we are testing the idea that the most lethal of heart rhythm disorders, ventricular fibrillation, is caused by the nucleation of a spiral wave of reentrant excitation, which subsequently disintegrates into multiple, self-perpetuating spiral waves. This process is facilitated by the dynamical heterogeneity of cellular electrical properties that arises from a steeply sloped electrical restitution relation (the relation between the duration of the cardiac action potential and the interval between action potentials). Recent experiments indicate that reducing the slope of the restitution relation, either pharmacologically or by overexpression of selected ionic currents, may prevent the induction and maintenance of ventricular fibrillation. We are now in the process of evaluating various methods of reducing dynamical heterogeneity, with the expectation that such an approach might provide an effective means of preventing sudden cardiac death, the leading cause of death in the US.

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More information, is available at my Life Sciences page.

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