Universidad Carlos III de Madrid

Seminario del Instituto Gregorio Millán

An invitation to collaborate: One-dimensional models for cardiac arrhythmias

Prof. David G. Schaeffer

Duke University ,

Resumen

In electrocardiology, the term action potential refers to the behavior that, in response to a brief stimulus, the electrical potential across cardiac cell walls is elevated for an extended period. The duration of action potentials under periodic pacing is an important quantity clinically, physiologically, and mathematically. At slow to moderate pacing rates, every stimulus produces an action potential of the same duration, but at high pacing rates cardiac tissue often undergoes a bifurcation to what is called *alternans*: i.e., uniform APD's are replaced by an alternation between short and long action potentials. In a single cell or a small piece of cardiac tissue, this bifurcation is a familiar period-doubling bifurcation, but when propagation effects are important the nature of the bifurcation to alternans is far from clear, even in problems with just one space dimension. For example, the short/long alternation may suffer phase reversals at various locations in the tissue. This behavior, known as *discordant* alternans, is considered to be a precursor to ventricular fibrillation.

Mathematically, these phenomena are governed by a system of reaction-diffusion equations. Echebarria and Karma proposed greatly simplified description of them, a modulation equation for a single unknown. Qualitatively, the bifurcations of the modulation equation match those of the full system, but quantitatively the discrepancies are rather significant.

In the lecture I will summarize the general context and propose some specific problems. These problems are directed towards understanding the behavior of solutions of the full system of reaction-diffusion equations, if possible building on the framework provided by the modulation equation. I hope others may find these problems attractive; I am eager to discuss them.

- DÍA Y HORA: **Miércoles 7 de octubre de 2009** a las **12:30**
- LUGAR: **Edificio Sabatini. Aula 2.1.D04**