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Computer Simulations Provide Insights About How the Heart Works

Mathematical modeling and computer simulations have provided many insights into the electrical behavior of the heart. However, models and simulations must be verified by experiments, and one way to experimentally measure the heart's electrical activity is to use optical methods and **voltage sensitive dyes**. But these experiments have their own limitations, which leads to more modeling, which leads to more experiments... It's an endless loop. In the June 2009 issue of the journal **Physica D**, CBR member **Brad Roth** published a paper about **'Hybrid Modeling of Electrical and Optical Behavior in the Heart'** (Volume 238, Pages 1019-1027). The paper begins

"Optical mapping of **transmembrane potential** using voltage-sensitive dyes has revolutionized **cardiac electrophysiology** by enabling the visualization of electrical excitation waves in the heart. However, the interpretation of the optical mapping data is complicated by the fact that the optical signal arises not just from the surface, but also from some depth into the heart wall. Here, we review modeling efforts, in which the **diffusion of photons** is incorporated into the computer simulations of cardiac electrical activity ('hybrid' modeling), with the goal of improving our understanding of optical signals."

SUMMARY

Mathematical modeling and computer simulations have provided many insights into the electrical behavior of the heart.

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