

RESEARCH INTERESTS

Wave propagation in the heart: theory and calculation.

In the heart muscle, the cell membrane acts as an electric capacitor that exhibits sudden depolarization and more gradual repolarization. This behavior (the action potential) propagates as a wave from cell to cell and governs the mechanical heartbeat. Very often, the propagation is well represented macroscopically, without reference to individual cells. Spiral-shaped waves have been observed, which are the surface manifestations of scroll waves inside the tissue. These reentrant excitations cause lethal arrhythmias; predictability is highly desirable. The mathematics is nonlinear and full of surprises. Even macroscopically, the local direction of the muscle fibers is important, as it gives rise to a nonuniform and anisotropic medium of propagation. My work aims at finding out how mathematical analysis can help understand numerical and real experiments in that context. Currently I am seeking to adapt diffuse optical tomography towards displaying an actual excitation wave in 3D.

Selected References

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