Theoretical and computational cardiology. Mathematical modeling of action potential and calcium cycling. Nonlinear dynamics of cardiac phenomena including alternans, early and delayed afterdepolarizations, Ca sparks, Ca waves.

Synopsis:
Sudden cardiac death is the leading cause of death in the United States. Our knowledge of sudden cardiac death is still limited. CAST (Cardiac Arrhythmia Suppression Trial) and SWORD (Survival With Oral d-Sotalol) clinical trials failed and tested drugs increased mortality. These single target drugs often cause unpredicted phenomena in the heart, which is the highly complex system. The complexities come from nonlinearities in the heart. The goal of my research is to understand how molecular level properties are linked to organ level phenomena using mathematical analysis and multiscale modeling of the heart.

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Graduate Group Affiliations:
View list

Title Assistant Professor, Pharmacology
Specialty Pharmacology
Department Pharmacology
Address/Phone Genome and Biomedical Sciences Building, Genome & Biomedical Sciences Facility, 451 Health Sciences Drive Suite 3503 Davis, CA 95616
Phone: 530-752-3200
Additional Phone Phone: 530-752-4440
Email dsato@ucdavis.edu
Education Ph.D., Northeastern University, Boston MA
B.S., Waseda University, Tokyo Japan
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